JUNE, 1952 Vol. 41, No. 6

INDUSTRIAL ARTS and VOCATIONAL EDUCATION

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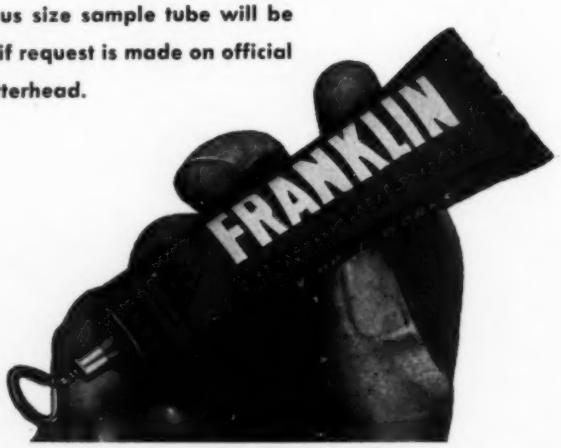

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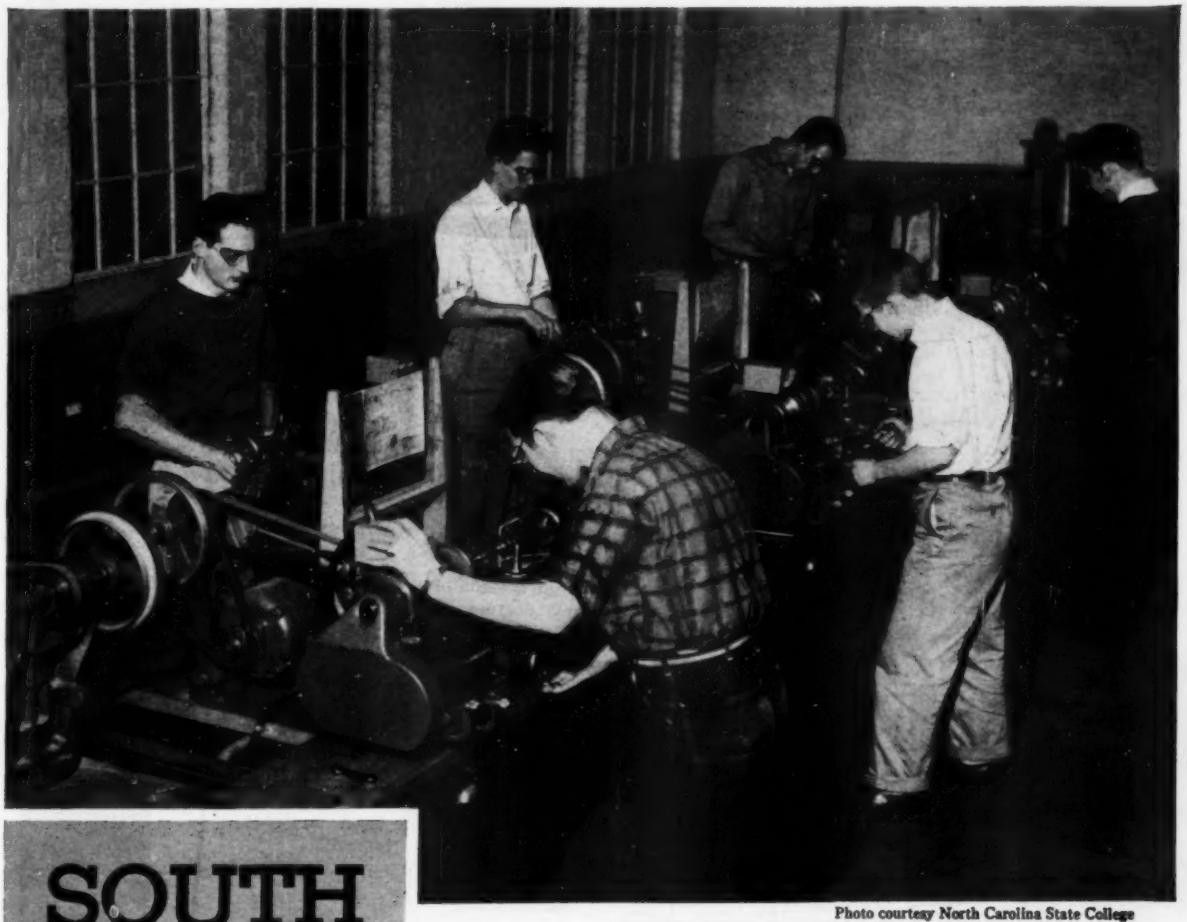

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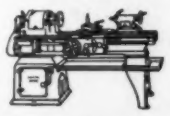

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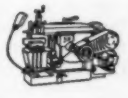

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Here are twenty elementary questions about files and filing. If you can answer 18 or more, your rating is *Excellent*; 15 to 17, *Good*; 10 to 14, *Fair*; less than 10—well, "school's in."

1. Why are Mill files so named?
2. How long (how measured) is an 8-inch file?
3. What are the 4 general types of file teeth?
4. What designations cover the 4 general degrees of coarseness in the more commonly used files?
5. In a double-cut file which is the "overcut" and which the "upcut"?
6. What are Swiss Pattern files and how, in general characteristics, do they differ from American Pattern files?
7. Special-cut (or special-purpose) files are generally used on what metals or alloys? Name 4.
8. What machinists' files are *not* double-cut?
9. What is a G.P. Machinist's file?
10. What type files come in flexible as well as rigid form; and how and on what are they generally used?
11. What distinguishes a Super-Shear from the usual file of its class?
12. What is drawfiling?
13. What is a Lead Float?
14. Why is a Bastard file so called?
15. What are the chief characteristics of a Lathe file?
16. As distinguished by cross section, name 8 common shapes of files.
17. What extra quality is needed in a file for stainless steel?
18. How does a Brass file differ from an ordinary Flat file?
19. How do Foundry file teeth differ from those of a Flat file?
20. Name 6 "Do's" or "Don'ts" that will lengthen the life of any file.

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Vol. 41 No. 6

JUNE, 1952

INDUSTRIAL ARTS *and* VOCATIONAL EDUCATION

THE SHOP TEACHERS' PROFESSIONAL MAGAZINE

Published on the 15th of month preceding date of issue

THE BRUCE PUBLISHING COMPANY, 400 North Broadway, Milwaukee 1, Wis. • CENTRAL OFFICE: 20 North Wacker Drive, Chicago 6, Ill. • EASTERN OFFICE: 225 Broadway, New York 7, N. Y.

★ ★ ★ ★

This Month's Cover

The cover picture for the June, 1952, issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION shows a student machinist working in the machine shop at the Milwaukee Vocational and Adult Schools, Milwaukee, Wis.

The photograph was submitted by Stanley O. Opsahl, instructor of photography at the above-named school.

Your Next Year's Address

To make sure that you will receive your September issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, send us your new address, including the zone number, together with your former address. Please let us have this information no later than August 20.

★ ★ ★ ★

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ASSOCIATION NEWS

COMING CONVENTIONS

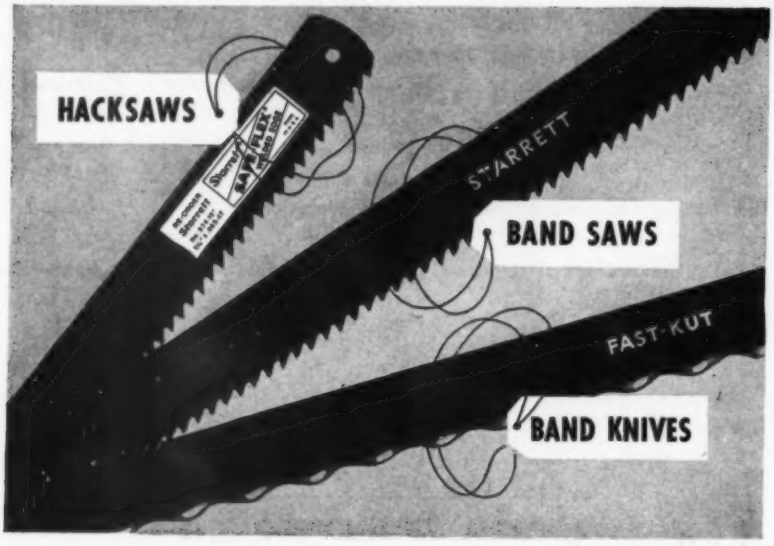
June 9–10. Georgia Vocational Association, at Savannah, Ga., Municipal Auditorium. Secretary, R. E. Hagen, 232 Pryor St. S.W., Atlanta, Ga.

June 10–12. Minnesota Vocational Agriculture Instructors Association, at St. Paul Hotel, St. Paul, Minn. Secretary, Henrik Aune, Morris, Minn.

June 18–20. Pennsylvania Vocational Association, at Forest Inn, Eagles Mere, Pa. Secretary, Ralph O. Grallington, 304 Burrowes Bldg., State College, Pa.

June 29–July 2. International Graphic Arts Education Association, at Loraine Hotel and Madison Vocational and Adult School, Madison, Wis. Secretary, Fred J. Hartman, 719 15th St. N.W., Washington, D. C.

Aug. 18–20. Colorado Vocational Association, at Colorado A. & M. College, Fort Collins, Colo. Secretary, Rhoda Foss, Colorado State College of Education, Greeley, Colo.



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IAPPC CABINET REPORT

The Industrial Arts Policy and Planning Committee of the American Vocational Association convened in the AVA offices in Washington, D. C., March 12–14, 1952.

Members present included Dr. Shriver L. Coover, head, industrial-arts department, State Teachers College, California, Pa., chairman; Verne L. Pickens, chairman, division of practical arts, vocational and family life education, Kansas City, Mo.; Dr. Stanley J. Pawelek, supervisor of industrial education, Baltimore, Md.; and Dr. Chris Groneman, head, industrial education department, Texas A. & M. College.

At this meeting plans were formulated concerning the industrial-arts section meetings and IAPPC meetings in conjunction with the 1952 AVA Convention in Boston, Mass., November 30 to December 5. Dr. James Hammond, director of industrial arts, State Teachers College, Fitchburg, Mass., will serve as general chairman for the industrial-arts sectional meetings.

INDUSTRIAL EDUCATORS' SUPERVISORY CONFERENCE

This conference will be held at Bradley University, Peoria, Ill., on July 31, August 1 and 2, 1952.

Glenn Fletcher, director of industrial education, Houston, Texas, will be the chairman of the conference.

Dr. Fred Strickler, professor of industrial education, Bennett College, Bradley University, Peoria, Ill., is the executive secretary.

Visitors are invited.

INDIANA INDUSTRIAL EDUCATION ASSOCIATION CONVENTION

Officers elected for the Indiana Industrial Education Association at the March, 1952, meeting held at French Lick, Ind., are: president, Lester Cunningham, Gary, Ind.; vice-president, Paul Lightle, Fort Wayne, Ind.

The meeting was attended by about 560 of the 700 association members — a very fine showing. — *H. G. McComb, Secretary-Treasurer.*

NEW JERSEY VOCATIONAL ASSOCIATION

At a meeting of the New Jersey Section of the American Vocational Association held at Asbury Park on March 19, 1952, the following officers were elected for the coming year: president, Owen Kiser, state supervisor of agriculture, State Department of Education, Trenton, N. J.; vice-presidents, trades and industry: John Bambara, teacher, Bloomfield, N. J.; distributive education: John Barbour, distributive education co-ordinator, Red Bank, N. J.; industrial arts: Richard O. Harthman, supervisor of industrial arts, Jersey City, N. J.; life membership: Samuel Martin, principal, Thomas E. Edison School, Elizabeth, N. J.; agriculture (1-year unexpired term): Clarence Davenport, teacher, Rancocas Valley High School, Mt. Holly, N. J. — *J. Henry Zanzalari, Secretary.*

SOUTH JERSEY SHOP TEACHERS' ASSOCIATION

The annual meeting and banquet of the South Jersey Teachers' Association was held on April 23, 1952, at the High School, Clayton, N. J. — *F. L. Creamer.*

(Continued on page 6A)

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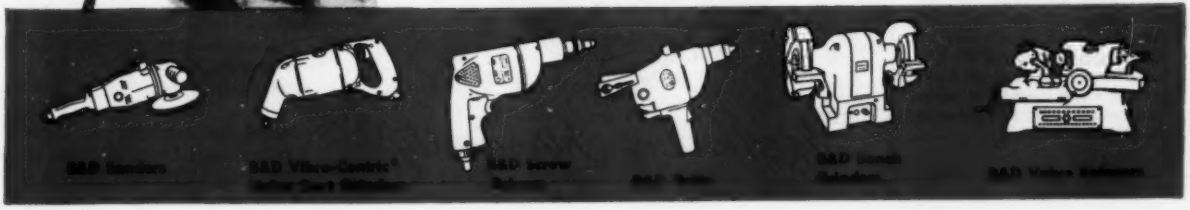


ASSOCIATION NEWS

(Continued from page 4A)

TEXAS VOCATIONAL ASSOCIATION

The eleventh annual Texas Vocational Association meeting was held in Houston, Tex., April 4 and 5, 1952. The high lights of the gathering were two addresses by Dr. M. D. Mobley, executive secretary, American Vocational Association.

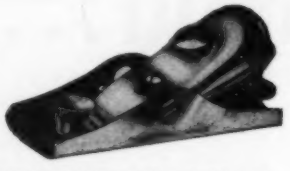
Presenting the topic "The Role of Vocational Education in Providing Freedom and Security for Individuals and the Nation," Dr. Mobley pointed out the dangers involved in the strides made by Russia in the training of workers in vocational fields. He drew a clear, sharp picture of the moneys being spent to bring foreign emissaries to this country to inspect vocational education programs suffering from reduction, curtailment, or elimination of funds for their support. Dr. Mobley also pointed out the significance of vocational education and practical arts education in the defense of a free nation.

In the trade and industrial education sectional meeting, Earl M. Bowler, assistant director of the industrial department, Extension Division of the University of Texas, compared certification laws in the various states. In essence, Mr. Bowler stated "The proposal to certify teachers of trade and industrial education on the basis of requirements set up in the Texas State Plan is sound procedure that should have the endorsement of all instructors." "The State Plan requirements for teachers in Texas compares favorably with the highest standards set in the nation," Mr. Bowler concluded.

Val Jean McCoy, Public Relations Director, The Shell Oil Company, Houston, Tex., addressed the trade and industrial group on "Forward Looking Practices in Industrial Education From Industry's Point of View." In addition, sectional meetings were held in industrial arts, homemaking, agricultural education, guidance and rehabilitation and veteran's education.

A final banquet with entertainment by student groups of the University of Houston and the usual presentation by the ships crew closed the 1952 meeting.

School Shop Favorites



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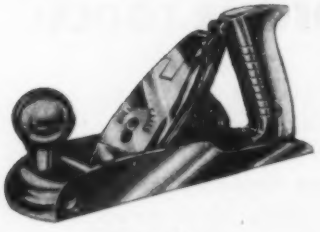

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SIGMA CHAPTER IOTA LAMBDA SIGMA BREAKFAST

The second annual breakfast of Sigma Chapter, Iota Lambda Sigma Fraternity at the University of Texas, was held in connection with the Texas Vocational Association meeting April 4, 1952, in Houston, Tex. Twenty-two members of the fraternity were in attendance at the meeting which was conducted by President H. D. Bearden, assistant vice-director of Industrial Engineering Service, A. & M. College, College Station, Tex.

High light of the breakfast program was a panel discussion entitled, "The Use of Public Relations in Developing Local Programs." Panel members included O. F. Higginbotham of Houston, M. Y. Johnson of Lamarque, R. E. Morley of San Antonio, Felix S. Hatchell of Bayton, J. E. Taylor of Dallas, and W. I. Lane of Fort Worth. Much interesting discussion followed the presentation of material by each panel member.

In addition to the program, a brief business session was held. Joe L. Reed, teacher trainer, Industrial and Business Training Bureau, the University of Texas, presented plans for the annual initiation and business session to be held on the campus of the University of Texas, July 9, 1952.

Members of Sigma Chapter toured the exhibits before the regular T.V.A. sessions began. — *Earl M. Bowler.*

♦ The Pennsylvania Industrial Arts Teachers Association held its meeting on April 25 at 6:30 p.m., in the Lebanon Junior High School, West Mifflin, Pa. Dewey F. Barich, manager of Industrial Arts Awards of the Ford Motor Company, addressed the meeting and showed the movie, "Pride of Workmanship," and the film strip on 1951 Industrial Arts Awards.

♦ The Annual Industrial Arts Club Conference was held at Mankato State Teachers College on March 20 with a dinner for seventy guests. Dr. V. C. Fryklund was the guest speaker who spoke on the topic, "Only the Free Can Be Educated." The industrial-arts teachers from the public schools in the area were invited to attend the conference again this year.

Officers of the club are: Lester Westenberg, president, Edgerton, Minn.; Allan Hohenstein, vice-president, Amboy, Minn.; Maynard Lager, secretary, Windom, Minn.; Chester Christeson, treasurer, Tracy, Minn. Maurice J. Nelson, dean of men and professor of industrial arts education, is the sponsor of the club.

Other staff members in the industrial-arts department at the college are: Dr. Carlton J. Gerbracht, Ira Johnson, and Lloyd Bjornstad.

The Industrial Arts Club hopes to continue this conference as an annual affair.

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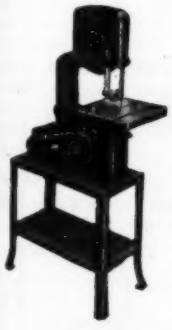

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10" SAW

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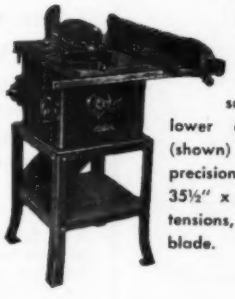

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DEAD-LINE — JULY 31, 1952

WHAT THIS CONTEST IS ALL ABOUT

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You are urged to submit your ideas on this subject—as one of the men best qualified to know school shop requirements, now and in the future.

At the close of the contest the best plans submitted are to be assembled in book form—as a service to school men throughout the world.

IT'S EASY TO ENTER

All you do is send for the Delta Official Contest Kit. It contains all the information you need—Contest Rules and Instructions, Entry Form, Official Floor Plan sheets and full directions on how to prepare your entry.

Important: There's time enough to prepare your ideas *if you act now!* July 31 midnight is the dead-line—and it's getting closer.

WHO DETERMINES THE WINNERS?

As you also know, the contest entries will be submitted to a panel of five distinguished judges, all leaders in the field of Industrial Arts and Vocational Education—

DR. C. C. CAVENY
Dean, Chicago Campus—University of Illinois

DR. C. H. GRONEMAN
Head, Industrial Education—Texas A. & M. College

HANS W. SCHMIDT
Former Building Service Supervisor—Wisconsin State Dept. of Education

DR. W. W. THEISEN
Ass't. Supt. of Schools—Milwaukee Public Schools

GILBERT G. WEAVER
Director of Training—State Education Dept., New York, New York

The decision of the judges will be final, of course; and all entries will be the property of Delta Power Tools

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3. **Junior High School Shops—7th, 8th, 9th Grades**
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☐ Please send me the Delta Official Entry Kit for the Delta School Shop Layout Contest

Name _____
Position _____
School _____
Address _____
City _____ Zone _____ State _____

Personal News

♦ Dr. Cyril F. Klinefelter, a Washington area resident for more than thirty years, died recently of a heart attack at his desk in the U. S. Office of Education.

At the time of his death, Dr. Klinefelter was a consultant in vocational education. He formerly was assistant to U. S. Commissioner of Education John Studebaker.

Born in Westfield, Ill., Dr. Klinefelter was a graduate of the University of Cincinnati and Ohio State University. He also held an honorary degree from the College of Puget Sound. He came to Washington 31 years ago to accept a government appointment.

He was a member of Phi Kappa Tau fraternity. He is survived by his wife, Lillian, and a brother.

♦ Dr. Linton E. Grinter, research professor of civil engineering and mechanics at Illinois Institute of Technology, has been appointed dean of the graduate school and director of research at the University of Florida, Gainesville, Fla.

He will assume the new post at the beginning of the fall semester.

♦ Dr. Robert B. Stewart, vice-president of Purdue University, and chairman of a Veterans Administration advisory committee on veterans' training, recently was awarded a certificate of appreciation by the VA for his "distinguished contribution to the government, to the cause of free education, and to the benefit of veterans," VA announced.

♦ Rudy P. Kaspar has been appointed manager of the sales engineering department of the A. B. Dick Company, Chicago, Ill.

♦ Orrin W. Barker, assistant chief engineer at Kearney & Trecker Corp., since 1936, was recently named chief engineer.

He has been continuously employed at Kearney & Trecker since 1925.

♦ George V. Radcliffe, M.Ed., Texas A. and M. College, B.S., Nebraska State, Kearney, Neb., now at the University of Idaho, is shaping up the state's industrial-arts teacher training program.

The department, in its fourth semester, with 35 majors and an enrollment of 87 students, was gutted by fire destroying all equipment and tools.

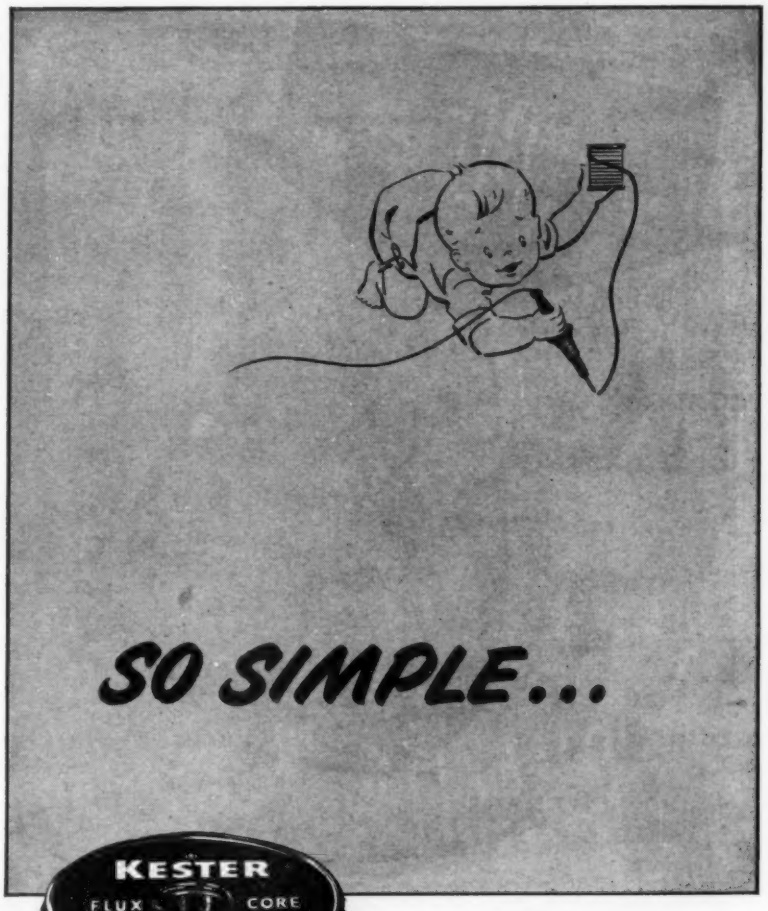
Classes were dismissed for the next two days while insurance adjustors and fire inspectors took over.

The following Monday students started salvaging what they could of their semester's work and moved it to an assigned temporary building. On Wednesday, with plenty of hand tools and a fair amount of power equipment set up, students went to work with few interruptions.

This feat was accomplished because the other schools within the institution extended their unlimited co-operation. The universities and the purchasing agent began at once to burn up telephone and telegraph lines, and succeeded to purchase or loan tools, equipment, and supplies. Before long everything was progressing as though there had been no fire.

♦ Raymond H. Larson was awarded the Ph.D. degree at the University of Minnesota on December 20, 1951, under the advisership of Dr. Homer J. Smith.

Mr. Larson received the B.S. degree (Nebraska) in 1937, and the M.A. degree (Minnesota) in 1939.



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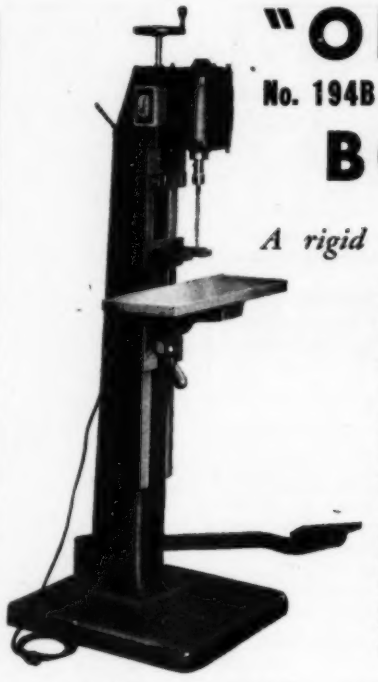

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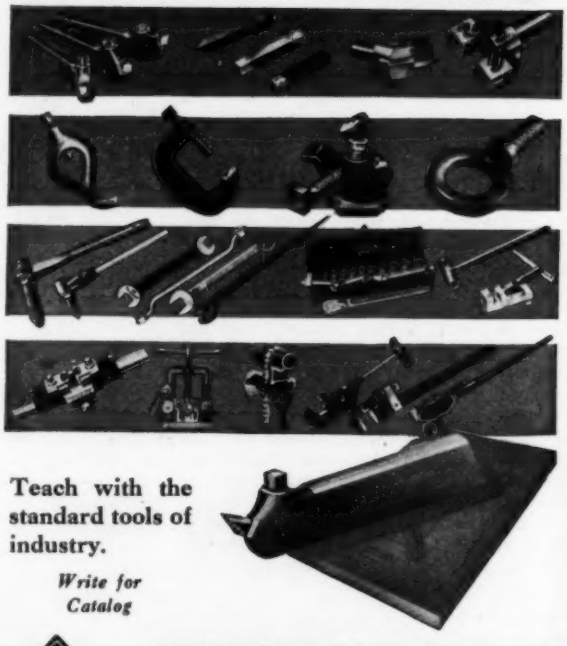

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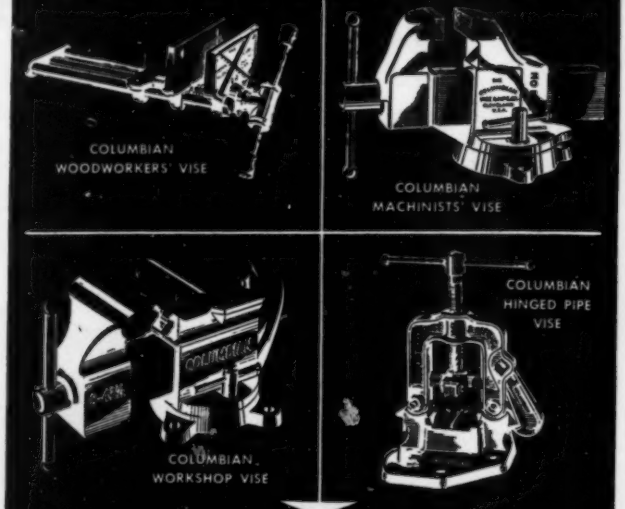

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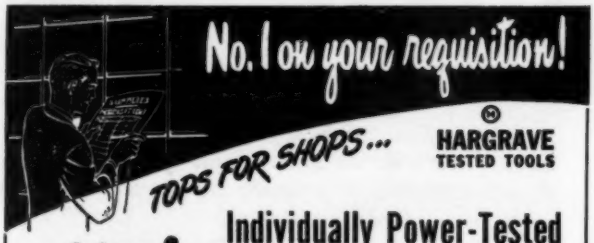

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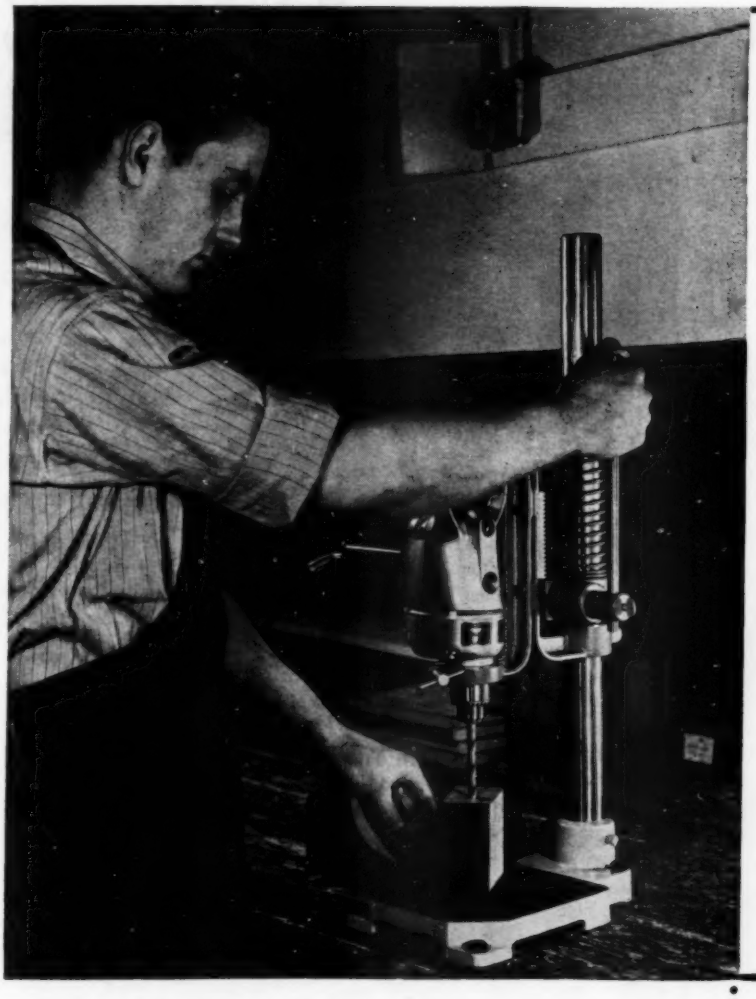

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JUNE 1952

Manual-Arts Therapy and Its Mental and Physical Demands

DR. EARL C. GLUCKMAN
Assistant Chief, Professional Services
and
HERMAN BROWN
Chief, Manual-Arts Therapy
Physical Medicine Rehabilitation Service
Veterans Administration Hospital
Bronx, N. Y.

As generally defined, *manual arts therapy* has for its role the exploration, evaluation, and development of a patient's capacities to meet the physical and/or mental demands characteristic of the graphic arts and mechanical trades. This role has been enunciated by the central office of the Veterans Administration which has been in the forefront of manual arts therapy with relation to the establishment of activity under medical prescription and supervision within the confines of a hospital. These therapeutic activities would be representative of the type of industry found in the surrounding community in which the hospital is located.

It has been definitely proved that this specialty can furnish the means by which patients' capabilities and interests may be explored, work performance evaluated, work capacities increased, and work techniques developed commensurate with residual disabilities to meet the physical and mental demands of industry. Therefore, the possibilities of readmission to the hospital due to occupational aggravation of the disability are greatly reduced. Whatever the exploratory period may reveal, the acquisition of a few elemental skills in this manner often proves of value to the patient, the ward physician, and the physiatrist, all of whom are then in a better position to consolidate the evaluation of the patient's physical and mental capacities as a result of treatment in one or more sections in the Physical Medicine Rehabilitation Service. The end result — the patient's post hospital vocation or vocational objective — is commensurate with the disability. Here is a practical and objective means which may be of diagnostic value to those physicians sufficiently informed and interested to take advantage of this tool.

Manual-arts therapy maintains as its criteria the establishment of activities which duplicate those found in the graphic arts and mechanical trades and industries. This makes it possible at one and the same time to observe the patient's response to the demands of a given trade while treating him under selected medical conditions. The physician therefore now has within his grasp a means of determining objectively the extent to which the patient is able to adapt to the particular demands characteristic of selected rehabilitation objectives. In addition, the patient's capacities, physical and mental, may be

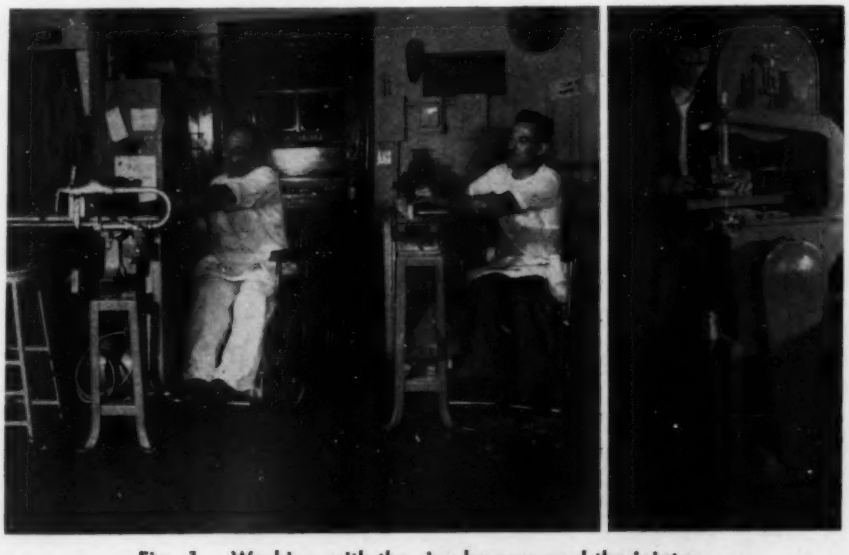


Fig. 1. Working with the circular saw and the jointer
Fig. 2. (at right): Using the band saw

Fig. 3. (at left): Working on the band saw
Fig. 4. (at right): Using the scroll saw

developed under medical supervision by gradually increasing the demands imposed upon him by the discipline of his choice.

This progressive development under the guidance of the manual-arts therapist develops new confidence in the patient in addition to discovering that the limitations imposed upon him by his disability are not insurmountable. On the contrary, he learns to make more extensive use of his capacity and with this realization comes the increased confidence in himself. This is buttressed by the discovery of new skills and the development of others which previously remained dormant. The renewal of his capacities, physical and mental, serves as an added stimulus in developing a wholesome interest in getting well. Where previously he hesitated to step forth from the protection of the hospital, he now looks forward to his discharge and gainful employment with renewed confidence. In sum, the patient is at once helped to recover physically, to develop proper mental attitudes, and to test his skill in the field of his choosing.

The procedure at this hospital is to accept referrals only through the ward physician. These referrals are first screened by one of the physiatrists who is the physical-medicine specialist who actually writes the prescription. The prescription is then routed to the particular section, in this case manual-arts therapy, whereupon the chief therapist interviews the patient and assigns him to the appropriate therapist, who adapts the program to the individual for the brief probationary period. At the end of this time a complete picture has been developed of the probable value of the program to the patient and its effect upon his future. Should the patient's field of endeavor prove unsuitable, we do not feel that time was wasted since he will have received benefits of his experience on a purely therapeutic basis.

Patients are also referred to the manual-arts therapy clinic from the Medical Rehabilitation Board, Vocational Rehabilitation, etc. Depending upon the patient's physical and/or mental disability, results of various aptitude tests given by the vocational rehabilitation and education division, and personal interests, educational background and experience, certain subject fields to be explored by the patient will be eliminated. Therefore, thorough observation of actual work performance is essential. The list of subject fields that can be surveyed, where applicable, is as follows:

Art metal and jewelry
Advertising
Auto mechanics
Commercial art
Blueprint reading and estimating
Commercial wiring
Drafting
Electrical appliance repair
Garment making
Lettering and layout
Machine shop
Photography
Photo-oil coloring
Precision casting
Radio and television
Silk screen
Show card writing
Watch repair

The manual-arts therapist is always alert to the objectives of his specialty as a member of the hospital staff. Helping to reduce the period of hospitalization to its minimum and helping to decrease the incidence of readmissions through his program of individualized attention to the patient's needs is of course basic to efficient hospital operation. Of no less importance are the therapist's concomitant efforts to help the patient meet the demands of daily living. With the aid of the physiatrist, he provides and develops techniques aimed

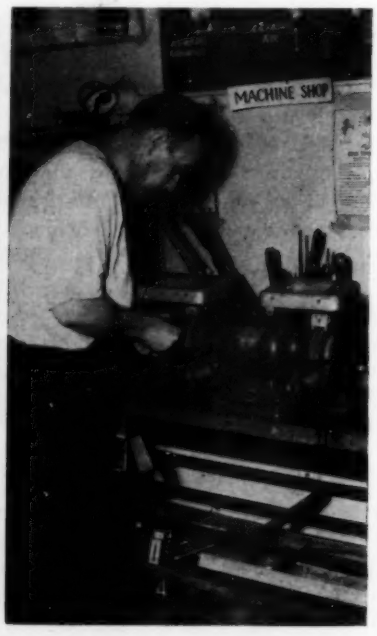


Fig. 5. (at left): Drilling holes
Fig. 6. Grinding tools

at developing mental as well as physical capabilities even as he attempts to evaluate the patient's potentials. At once, he engenders deeper interest on the part of his patients, assisting wherever and however possible toward the ultimate vocational objective. The patient may not have a new vocation in mind, but still the development of an avocation cannot entirely be eliminated from the value of the therapeutic treatment received. This is especially true in the case of neuropsychiatric problems where the therapist must always attempt to provide the incentive and opportunity in the exploration of various fields of endeavor. Whatever is done for the patient, it is essential that the sound principles of practicality guide all concerned in developing the patient's interest aptitudes and endeavors within the limitations imposed upon him by the disability.

Preparation of the General Shop Teacher

MARSHALL L. BYRN*
and
FRANCIS W. DALTON
University of Michigan
Ann Arbor, Mich.

The experiences that are essential for the development of the general shop teacher divide themselves quite naturally into three general aspects, cultural, shop training, and professional.

Cultural Background

The general shop teacher must possess the same culture and refinement that is expected of teachers in other branches of the school system. For instance, a thorough grounding in the arts and sciences will add much to the success of industrial-arts teachers. The same may be said of other fields of learning. It is generally agreed that culture is a way of life rather than just the acquisition of a means of information. However, the development of culture is hampered by ignorance of the important fields of learning. Therefore, such fields as English, mathematics, chemistry, physics, social sciences, graphic and plastic arts, health education, modern languages should be a part of the educational background of every industrial-arts teacher.

It is quite obvious that the general shop teacher cannot pursue all the above subjects to their limits. Nevertheless, it is extremely important that he thoroughly acquaint himself with the contributions that these studies make to school curriculums and to the conduct of successful teaching.

It is noteworthy that an increasing number of general shop teachers are in possession of the bachelor's degree and an ever increasing number are acquiring the master's degree. This condition would seem desirable. There is no valid reason why the general shop teacher should not be able to speak and write correct English and possess an appreciation of literature in general. A casual inspection of the content and activities presented in the general shop indicates the necessity for a knowledge of mathematics, physics, and chemistry. With reference to social sciences, they are especially valuable for the shop teacher as a foundation for an economic environment in which we live. The studies in the graphic and plastic arts are valuable because of the opportunities presented for the appreciation of design, shape, and color harmony which they give the prospective general shop teacher. A knowledge of health education is essential to the development of one's personal efficiency. And the ability to prepare and give a good talk will be found to be of considerable value to the shop teacher.

Shop Training

The general shop teacher needs as much shop training as is practical in the usual four-year undergraduate courses and at least as much skill as he expects to develop in his pupils. The specific subject teachers need, in addition to the cultural background required of all teachers, a complete mastery of the subject matter of his individual course. However, it should be pointed out that the general shop teacher, on the other hand, is not called upon to teach a vocation, but rather he must teach a course which is rich in opportunities for exploration and guidance. Therefore, he especially needs courses in drawing, woodwork, sheet-metal work, plumbing, printing, forging, ceramics, auto mechanics, foundry, finishing, and design. He should have in addition to the above a well-planned course in occupations and careers. It may be well to point out that such a course should include a visitation and observation of different types of industrial plants and places of business. It should be noted however, that the fact that the general shop teacher is not called upon to teach a vocation does not infer that he should not be able to successfully demonstrate the fundamental skills of such subjects as he includes in his courses. This ability is a fundamental necessity for a successful program.

It is to be remembered that since there are a large number of skilled trades involving a great mass of technical and related information, it is not possible for a teacher to become thoroughly proficient in more than one or two at the most. This is not considered to be a handicap, in fact, there is growing sentiment to the effect that the more able general shop teachers are not tradesmen but rather men

*Deceased.

of wide shop training who know how to organize teaching materials and have the ability to present them to a class in a professional manner.

As has been previously intimated a very important and desirable phase of the general shop teacher's preparation includes a special course or courses in which a study is made of industrial and business information. Unless such information is provided for the teacher through teacher-training courses, he is not likely to have it, since it is generally quite impossible for him to make sufficient and desirable contacts with industrial plants. The teacher needs such information about the industries as is of use in the guidance and general educational program, therefore, the general shop teacher should be familiar with the industries in general. The specific industries that the teacher will emphasize in his classes will depend for the most part upon the industrial needs of his teaching locality, however, it is desirable that the pupils be given an accurate conception of industries as a whole.

This type of training probably would be less essential for the preparation of the teacher of a trade. In the latter situation the objectives would be strictly vocational, and in which case the teacher should be not only a complete master of the subject but know how to teach it. It should be remembered that the aims of the general shop are not considered to be primarily vocational. The general shop should give the pupil an opportunity to achieve desirable developmental experiences through work on practical projects; it should give guidance and acquaintance with general educational materials through actual manipulation accompanied by the presentation of related information, all of which should place considerable emphasis on consumer information.

Professional

A teacher is not prepared to carry on a general shop course until he has a thorough grounding in the elements required of a successful teacher. Such subjects as psychology, philosophy of education, principles of education, curriculum construction, special methods courses in the industrial-arts field should be a part of every general shop teacher's training.

It is not intended to discuss here in detail all of the courses in education that are essential to the full development of a general shop teacher. In brief, he needs knowledge which will enable him to understand his pupils, organize his teaching material, be able to interpret and put into effective operation the aims and objectives of the course, all in the light of the adequate understanding of modern industry and an appreciation of the social and individual differences that will occur in his classes.

It has become increasingly evident to teachers of experience that no one type of training will fit a young teacher for all types of positions. It is recognized that the general shop teacher will find much of value in specialized training, however, the greatest opportunity for development probably will come when the teacher is on the job responsible for his own shop. Real experiences are needed to focus the learning and growing that has taken place in the preparatory stages of the teacher. This general shop teacher who is considered reasonably well trained and who has made his professional debut cannot afford to consider his preparation at an end. He should keep abreast of developments by professional reading, nor can he afford to disregard the opportunities for growth provided in our teacher-training and graduate institutions during summer months. Summer classes are especially valuable because of the fact that they are usually made up of experienced teachers from the field, and the opportunity to exchange ideas can be very fruitful.

Teaching Motion Economy in the Industrial-Arts Shop

JOHN A. McCLURE
Assistant Professor of Industrial Arts
Santa Barbara College
University of California
Santa Barbara, Calif.

The phenomenal increases in industrial productivity in this country over the past several years has been the result, in large measure, of improved methods through the application of motion economy. In addition, better product quality, safer and better working conditions, with reduced costs and higher wages have been inevitable side gains. The possibilities for raising our standard of living further through this tool of industrial management is just beginning to be appreciated by some of our farmers and a few merchants but the general public — and educators — have practically no knowledge of this valuable tool. There even remains large numbers of smaller industries that could benefit tremendously from the application of motion economy in the improving of their manufacturing methods.

Teachers of industrial arts, especially in senior high schools, are in a favorable position to contribute to the immediate production emergency and to the long range increase of national productivity by spreading more widely the knowledge of motion economy. This is a phase of general education which has remained untouched. It is general education because 90 per cent of our working population earns a living through some agricultural or industrial occupation.

Motion and time study has been taught to college students majoring in industrial engineering and industrial management and to foremen in industry. These courses have included the application of proved basic principles for improving work methods in a variety of jobs and the setting of performance standards for these jobs. The application of these principles by our engineers and management men has resulted directly in increased production at lower costs yet only a very small number of persons have been reached who are in a position to present valuable suggestions for job improvements and who could greatly improve their own work methods.

The principles of motion economy as used in work simplification can be understood and applied by the average high school student. He doesn't need to be in industry to apply them — there are plenty of situations that he can find in his own sphere of activity or that can be brought to him in the industrial-arts shop that will help him to understand motion economy and make it a part of his valuable fund of knowledge. We need to develop a motion-economy-mindedness in our people — thinking and planning before starting a task so that it can be done in the simplest and easiest way with a minimum of effort. This doesn't mean a speed-up, it means the elimination of wasted effort. Once a person has become motion economy conscious, and has learned to apply the simple principles, wasted effort becomes apparent to him and a desire to reduce or eliminate it becomes urgent.

Those who have read the delightful book, *Cheaper by the Dozen,* or saw the motion picture of the same title will recall that the story was based on the real life experiences of the Gilbreth's, the originators of motion economy. Unfortunately, the producers of the film missed an opportunity, which Frank Gilbreth would not have missed, to get a message across plugging motion economy for each and every one of us. The application of the scientific method was so thorough and complete in this early research of the Gilbreth's into the minute fundamental body movements used in doing work that the tools of analysis and the principles worked out by them have been changed but little for today's widespread applications. It is surprising that the general public knows so little about this extremely valuable technique.

Motion study is scientifically applied common sense. It consists essentially of the use of certain tools of analysis, the questioning of all factors involved in the work studied and the application of the proved principles of motion economy for methods improvement. The tools of analysis that can be profitably taught to the high school student are (1) how to make and use simple process charts and flow diagrams, (2) preparation and use of activity charts, and (3) the right-and-left hand operation chart. The process chart and flow diagram is used to picture the path and distance traveled by a person at work or by material being worked on. It helps to point out excessive walking or travel and when back-tracking occurs. The activity chart plots what the operator is doing and what the machine is doing during a work cycle. It points out, rather forcibly, expensive idle time of the machine — the key to real savings. The right-and-left hand chart reveals tiring functions such as needlessly holding the part being worked on in one hand, and when materials or hand tools are too far away from the point of use. Such charts make it possible to see the forest — and the trees.

The following are some of the principles of motion economy that can be understood and applied by the high school student in improving work methods:

1. Motion of the two hands should be simultaneous and symmetrical.

2. Tools and materials should be located close in and directly in front of the operator so as to be within easy reach of the hands.

3. There should be a definite and fixed place for all tools and materials.

4. Gravity feed bins and containers should be used to deliver material close to the point of use.

5. Tools and materials should be prepositioned wherever possible.

6. *Drop deliveries* should be used wherever possible.

7. The hands should be relieved of all work that can be done more advantageously by the feet.

8. Smooth motions of the hands are preferable to zigzag or straight-line motions involving sudden and sharp changes in direction.

9. Materials and tools should be located to permit the best sequence of motions. Rhythm is essential to a smooth, easy work pattern.

10. The height of the work place and the chair should preferably be arranged to permit alternate sitting and standing at work.

Problems or projects that can be used in learning the principles and tools of analysis could include home tasks — mowing the lawn, baking a pie, making a bed; assembly jobs — clearance lights, light plugs, fuel pumps, other articles from an automobile appliance store; work place layout — in the print shop, the woodshop, the auto body shop, the general metal shop. Excellent films are available that help get the ideas across.

It is not necessary to introduce a course in motion study in the high school. At the early meetings of the class in any of the shop courses a few hours could be spent on the various types of analysis charts and the principles as applied to some of the projects that have been listed. Then later, as the student sets up for each job in shopwork he could apply the principles learned.

What can a program in motion study hope to accomplish? It would be possible to reach a vastly larger segment of our working population when the mind is more receptive to such an idea and at small cost. Employers would welcome applicants who can plan and work efficiently. It would become unnecessary to *unlearn* bad work habits when later changes in methods were made. Increased productivity with no unreasonable increase in effort or time can be a real wage increase and one gladly given. Inventiveness is stimulated because the application of motion economy provides one of the best means available for teaching the scientific method. Training in motion economy decreases resistance to change. It gives us a better understanding of working fast as against working efficiently, a realization that the person who appears to be working fastest is not always accomplishing the most. Motion study, because its principles and tools are readily understood and applied, is fun to teach. Arousing and maintaining interest is natural because the challenging problems can be geared to individual capacity to solve them and resulting in a genuine sense of accomplishment.

How can industrial-arts teachers prepare themselves to teach motion study? First, they should enroll in a course in motion and time study. Nearly every major university in the country that has an extension program offers or can offer a course

in motion study. It probably would be better for a group of teachers to help organize a class that could be planned for their own needs so that they could work out an effective program together. Such a group should be able to get real and current methods problems from local industries for study. As you experiment and gain experience in your own classes exchange information with your fellow teachers at meetings and through such magazines as INDUSTRIAL ARTS AND VOCATIONAL EDUCATION. This is something that should become an integral part of industrial-arts education and therefore needs to be carefully developed by each and every industrial-arts teacher. Teacher training should also include a course in motion study for those preparing to teach industrial arts. We could all apply motion economy to our own jobs and realize marked improvement. Do you accept the challenge?

* * *

World petroleum demand, exclusive of Soviet-controlled areas, passed 10 million barrels per day for the first time in history during 1950.

A Testing Technique For Objective Type Questions

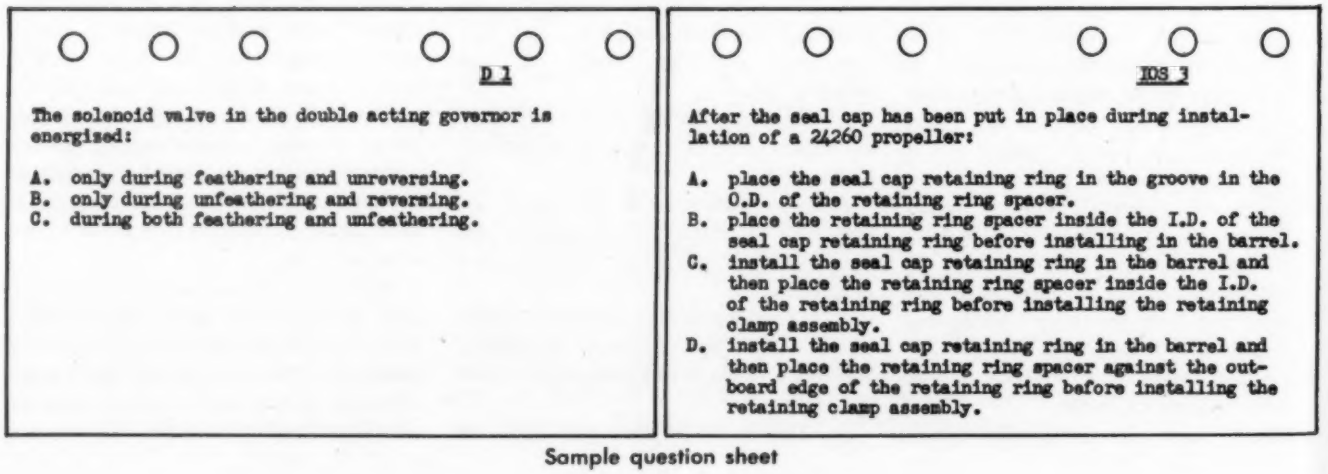
D. L. BALLARD
Service School Supervisor
Hamilton Standard Division
United Aircraft Corporation
East Hartford, Conn.

At the Hamilton Standard Division of the United Aircraft Corporation we operate a school for the training of customers' personnel and our field men on the service, maintenance, and overhaul of the aircraft equipment we produce. We believe that each student should be able to demonstrate his competence not only in practical work but in suitable examinations both oral and written. The objective multiple choice type of question has been chosen as one suitable method of examining our trainees. The time spent at our school may be a few days or several weeks and the nature of the instruction varies with the specific needs of each student or group of students. Consequently, at first, we were plagued with the necessity of revising our examinations for almost every class. As a result of this annoyance, we developed the system outlined in this article, and have found it so convenient that it is presented for the consideration of other training activities.

Each question is typed on a sheet of paper approximately 4 by 6 in. which bears a code letter and number to identify the type of equipment that it covers. The question sheets are suitably punched to fit a small notebook and a file is maintained which holds 25 copies of each question.

A master book holds a copy of each multiple choice question with the correct answer indicated. When it is desired to prepare an examination, the instructor takes one of the regular 50 question answer sheets and goes through the master book selecting the questions he wishes to use. He writes the code number of the question and the correct answer on the sheet. When this is completed his part of the job is done. The choices that he has made are then approved or modified by the school supervisor. This sheet is then handed to a clerk who picks out the appropriate question sheets from the master file and places them in one of the small notebooks. She then prepares answer sheets by listing the code numbers of the questions in the same order as they are arranged in the examination book.

When the student takes the examination, he selects what he believes to be the correct choice for each question and places one of the letters A, B, C, or D opposite the code number on his answer sheet. We



D 1

The solenoid valve in the double acting governor is energised:

A. only during feathering and unreversing.
B. only during unfeathering and reversing.
C. during both feathering and unfeathering.

IOS 3

After the seal cap has been put in place during installation of a 24260 propeller:

A. place the seal cap retaining ring in the groove in the O.D. of the retaining ring spacer.
B. place the retaining ring spacer inside the I.D. of the seal cap retaining ring before installing in the barrel.
C. install the seal cap retaining ring in the barrel and then place the retaining ring spacer inside the I.D. of the retaining ring before installing the retaining clamp assembly.
D. install the seal cap retaining ring in the barrel and then place the retaining ring spacer against the outboard edge of the retaining ring before installing the retaining clamp assembly.

Sample question sheet

use the *open book* type of examination and have found that a time limit of one and one-half minutes per question is reasonable.

As soon as the examination is completed, the clerk can score it using as a key the original answer sheet made out by the instructor during the selection of the questions. The examination is then discussed with the students so that they know the correct answers to those questions that caused difficulty. The clerk returns the question sheets to the master file and the answer sheets are destroyed.

We particularly like the flexibility of this system since it permits us to choose questions for the examinations in proportion to the amount of training given on each phase of the many different pieces of equipment we manufacture and sell.

There is considerable work to the development of such a system but it will be found to be well worth the initial time consumed. It is easy to revise any question that is found to be ambiguous or remove one that is no longer applicable. Also, new questions may be added with a minimum of effort.

Name J. Powers + W. Higdon (KEY)
Date 9-29-51 Score

Do not make any mark on the examination sheets. Select the best possible answer and record on this sheet the letter which represents your choice.

Ques.	Code No.	Answer	Ques.	Code No.	Answer
1.	G1	B	26.	SH5	C
2.	G3	C	27.	S3	C
3.	G7	A	28.	S8	B
4.	D1	B	29.	S9	C
5.	D2	A	30.	S10	B
6.	D3	B	31.	S14	C
7.	D10	C	32.	S17	C
8.	D12	A	33.	S23	D
9.	D16	B	34.	Ed4	C
10.	D17	D	35.	Ed10	A
11.	D18	C	36.	IOS2	B
12.	D19	A	37.	IOS5	B
13.	R3a	B	38.	IOS6	C
14.	R5	D	39.	IOS8	A
15.	R8a	C	40.	IOS9	B
16.	R9	B	41.	IOS11	D
17.	R10	C	42.	IOS13	D
18.	R11	D	43.	IOS15	C
19.	R13	A	44.	IOS27	A
20.	R16	B	45.	IOS28	A
21.	R18	D	46.	IOS33	D
22.	R19	A	47.	IOS35	B
23.	R20a	B	48.	I3	A
24.	R21a	C	49.	I7	C
25.	SH1	B	50.	I8	D

Key sheet

Name James Powers
Date 9-29-51 Score

Do not make any mark on the examination sheets. Select the best possible answer and record on this sheet the letter which represents your choice.

Ques.	Code No.	Answer	Ques.	Code No.	Answer
1.	G 1		26.	SH 5	
2.	G 3		27.	S 3	
3.	G 7		28.	S 8	
4.	D 1		29.	S 9	
5.	D 2		30.	S 10	
6.	D 3		31.	S 14	
7.	D 10		32.	S 17	
8.	D 12		33.	S 23	
9.	D 16		34.	Ed 4	
10.	D 17		35.	Ed 10	
11.	D 18		36.	IOS 2	
12.	D 19		37.	IOS 5	
13.	R 3a		38.	IOS 6	
14.	R 5		39.	IOS 8	
15.	R 8a		40.	IOS 9	
16.	R 9		41.	IOS 11	
17.	R 10		42.	IOS 13	
18.	R 11		43.	IOS 15	
19.	R 13		44.	IOS 27	
20.	R 16		45.	IOS 28	
21.	R 18		46.	IOS 33	
22.	R 19		47.	IOS 35	
23.	R 20a		48.	I 3	
24.	R 21a		49.	I 7	
25.	SH 1		50.	I 8	

Blank answer sheet

Name James Powers
Date 9-29-51 Score 86%

Do not make any mark on the examination sheets. Select the best possible answer and record on this sheet the letter which represents your choice.

Ques.	Code No.	Answer	Ques.	Code No.	Answer
1.	G 1	B	26.	SH 5	C
2.	G 3	C	27.	S 3	C
3.	G 7	A	28.	S 8	B
4.	D 1	B	29.	S 9	C
5.	D 2	A	30.	S 10	C X
6.	D 3	C X	31.	S 14	C
7.	D 10	C	32.	S 17	D X
8.	D 12	A	33.	S 23	D
9.	D 16	B	34.	Ed 4	C
10.	D 17	D	35.	Ed 10	A
11.	D 18	C	36.	IOS 2	B
12.	D 19	B X	37.	IOS 5	B
13.	R 3a	B	38.	IOS 6	C
14.	R 5	D	39.	IOS 8	A
15.	R 8a	C	40.	IOS 9	B
16.	R 9	B	41.	IOS 11	C X
17.	R 10	C	42.	IOS 13	C X
18.	R 11	D	43.	IOS 15	C
19.	R 13	B X	44.	IOS 27	A
20.	R 16	B	45.	IOS 28	A
21.	R 18	D	46.	IOS 33	D
22.	R 19	A	47.	IOS 35	B
23.	R 20a	B	48.	I 3	A
24.	R 21a	C	49.	I 7	C
25.	SH 1	B	50.	I 8	D

Student's answer chart

Early Conceptions of Industrial Arts

WILLIAM T. BAWDEN
Emeritus Professor
Kansas State Teachers College
Pittsburg, Kans.

(*Concluded from page 158 of the May, 1952, issue*)

GILBERT BURNET MORRISON

Principal, William McKinley High School, Saint Louis, Mo.

NOTE. Born, 1862; died, 1913. Teacher and superintendent of schools in Missouri; teacher of physics, Central High School, Kansas City, Mo., 1883–97; first principal, Manual Training High School, Kansas City, 1897–1904; first principal, William McKinley High School, Saint Louis, 1904–13.

It has been my observation that this work makes the pupils more manly and womanly, and less given to frivolity. It has a decided influence on their attitude toward work, and toward people who follow manual occupations.

It improves a pupil morally because it increases his respect for honest, painstaking work. Every good thing in this world may be traced to conscientious, self-sacrificing work. When we have increased a boy's respect for work, we have made him better morally, as well as intellectually. . . . I do not think the same results can come in the same degree from the purely academic work.

The work of manual training is chiefly formative rather than reformative. I have not observed that boys who are naturally bad morally are much improved by manual training. On the other hand, many who are considered bad, but who are not so — needing only occupation — are sometimes reached, and by this means led to other forms of activity.

It is a very interesting and significant fact that boys with decided criminal tendencies do not take to manual training. They always want to drop it and take up something else. Laziness is a trait of criminality, and is often the cause of it. A criminal is an individual who wants to live without work.

FRANK CUSHMAN

Instructor, Manual Training High School, Kansas City, Mo.

NOTE. Born in East Boston, Mass., July 15, 1879. Studied at Massachusetts Institute of Technology, and served three years, 1898–1901, as assistant instructor, same; instructor, Manual Training High School, Kansas City, Mo., 1901–08; principal,

same, 1910–13; principal, Lathrop Trade School, Kansas City, 1920; regional agent, Federal Board for Vocational Education, 1918–22; chief of trade and industrial education service, same, 1922–38; consultant in vocational education, U. S. Office of Education, Washington, D. C., 1938–46. In 1926–27, he served as supervisor of industrial education in the public schools, Los Angeles, Calif.; and five years, 1940–45, as Commander, U. S. Naval Reserve. Since 1947, he has been educational consultant, Management Engineers, Inc., Long Beach, Calif.

One of the principal points in which manual training has an advantage over purely academic subjects is that in manual training the pupil is brought face to face with real objects in place of theories and abstract information.

For example, a machine tool admits of no argument, and is no respector of persons. The necessary conditions must be complied with or the work will be spoiled and possibly the tool injured. There is no chance of attaining any degree of success by guess work and haphazard methods. . . . A student patiently working out his exercise from the drawing is surely acquiring decision of character and the habit of acting promptly at the required time.

As a study for the development of honesty, fixity of purpose, decision of character, and the cultivation of good common sense, the value of manual training cannot be overestimated.

In manual training work the boy is simply forced to do his work honestly and to stand on his own feet, as it were. There is very little *luck* in working with tools; conditions must be right or the desired result cannot be obtained. . . . During his manual training course the boy is surely and steadily forming the habit of being honest with himself and his work. . . .

Manual training goes a long way toward bridging the gap between abstract knowledge and practical things. In my judgment this lack of connection is one of the very weakest points in our system of education.

CHARLES F. WARNER

Principal, Technical High School, Springfield, Mass.

NOTE. Organized and served as the first principal of the Technical High School, which opened in September, 1898, and was designated the "Mechanic Arts High School." In October, a new public evening trade school was organized in the same building, making use of the same equipment, and employing the same instructors as the day high school. "This evening trade school is said to be the first school in the United States to offer trade training at public expense."[5]

The results (of manual training instruction) are so intangible that it is almost impossible to reduce them to the definiteness of a report. I fully believe in much of the theory of the moral effect of manual training. . . .

I have seen a great many boys developed morally as well as intellectually — that is, strengthened all along the line — as the result of the influences which have been brought to bear upon them while they were members of a manual training high school . . . but just where the manual training work itself took hold — that is, just how much is due to manual training and how much is due to all the other influences — is a matter that is entirely beyond me to tell with any degree of scientific precision. . . .

The training derived from any particular activity or experience of the faculties is much less general than has formerly been supposed; in fact, I think it is quite special. That is, if a boy is trained along the line of accuracy in drawing or woodwork, it does not necessarily make him accurate in some other things, as English or mathematics. The accuracy developed is of a peculiar kind, and its derived usefulness is to be sought for in the same field or in similar fields of further activity, not in dissimilar fields. . . .

I believe that altogether too much of general value has been claimed for manual training, as also too much has been claimed for the training derived from the older school studies. The dogma of formal discipline has been quite thoroughly exploded.

This does not mean either that there is little value in manual training in a broad way, or that there is no special value in it. It is merely another statement of the old principle that there is no royal road to learning, to moral character, and to all the rest of the good things that come from education, ***through manual training***, any more than there is through any other kind of training. . . .

The thought to be emphasized is the value of interest on the part of the pupil in keeping him in school until his character is formed as well as may be by all the influences which the school has to offer. And the great value of manual training is that it appeals to so many boys and girls along the line of interest, leading them to continue their schooling and get all its benefits. With this view of the case it would appear that manual training is of great value to the cause of education in general because it assists powerfully in making larger and better schools. Its value along this line is much greater than its value as a special means of cultivating any particular virtues that have failed of cultivation under other lines of work.

Another strong and valid point to be urged in support of manual training is the great value of the technical knowledge gained by the pupil in a properly ordered course. The industries justly claim a share in the school program. In an industrial age, and in a country where a large majority of the people are now living and are to continue to live an industrial life, it is manifestly unfair not to recognize these facts in the school system. . . . It is the duty of the school to lay the foundations for life, and when that life must be so largely an industrial life, industrial education becomes a social and moral question. . . .

I would emphasize the general industrial and social uplift which can be traced directly to the modern expansions of the public school, including manual training and all that that stands for, rather than upon individual instances of reformation.

HENRY SMITH PRITCHETT

President, Massachusetts Institute of Technology, Cambridge, Mass.

NOTE. Born at Fayette, Mo., April 16, 1857; died, August 28, 1939. He was a graduate of Pritchett College, Glasgow, Mo., A.B., 1875; University of Munich, Bavaria, Ph.D., 1894; also recipient of numerous honorary degrees. Assistant astronomer, United States Naval Observatory, Washington, D. C., 1878; astronomer, Morrison Observatory, 1880; astronomer, Transit of Venus Expedition to New Zealand, 1892. Professor of astronomy and director of the observatory, Washington University, St. Louis, Mo., 1883–97; superintendent, U. S. Coast and Geodetic Survey, 1897–1900; president, Massachusetts Institute of Technology, 1900–06; president, Carnegie Foundation for the Advancement of Teaching, 1906–30.

[5]Bennett, *History*, *op. cit.*, p. 384.

No school and no other human agency can hope to offer to a youth all the opportunities by which these approaches to the soul may be utilized. The manual training school has brought an intellectual quickening to a very large number who would never have responded to the teaching of the old-time school. To have furnished such an avenue of development for minds which failed to find such under older formal methods of instruction is a distinct and noteworthy gain.

The manual training school has also made a great contribution to the cause of education by the fresh demonstration which it has given of the pedagogic value of mechanical and freehand drawing. The value of this lesson it would be difficult to overestimate. . . .

On the negative side, the manual training school has shared with all other educational efforts in America the characteristics of our time and of our people. Enthusiastic friends have claimed for it more than it has done or can do. While it is true that many students find in manual training instruction new means for intellectual quickening, it is true also that this school is no more fitted to the needs of all boys than is the school of any other type.

And no school has shared more fully in the dilution of scholarship which comes from trying to teach too many subjects in a short time than the manual training school. The motto, "The cultured mind, the skillful hand," which one finds over the doorway of every manual training school, is adapted to the spirit of St. Paul's definition of faith, "The substance of things hoped for, the evidence of things not seen." . . .

There is a popular impression concerning the work of the manual training school which is somewhat misleading, namely, the belief that the practice and instruction which a boy receives in the school shop are an equivalent for the experience which he obtains in dealing with the physical problems of an outdoor life, such, for instance, as comes to a boy raised on a farm.

The experience which a boy gets in the use of tools in the school, as well as that which he gets in the use of tools on the farm, falls short of skill; but, in the one case he deals with the actual problems and difficulties of daily life, and his resourcefulness and ability to solve a problem with the means at hand are constantly strengthened. For most city boys the work in a well-kept shop is as much apart from the daily problems of life as are the lessons in Latin; and, while they appeal in a new way, and often a most successful way, to the boy's intelligence, they do not take the place of the experience with living problems.

Influential Support

The first point to be noted in a review of these expressions of opinion dating from the early 1900's is the unanimity and earnestness of the support of the manual training movement manifested by these leaders of the educational thought of their day. It is a remarkable tribute to the persuasiveness of Dr. Calvin M. Woodward, Dr. John D. Runkle, and the other pioneers, as well as to the solidity of the foundations which they laid, that when these letters were written not more than 25 years had elapsed since the founding of the first manual training school, in St. Louis. This was indeed a brief period within which to convince so many national leaders in education of the value of the new and untried, not to say revolutionary, manual training movement. There seems to be evidence that the list of "testimonials" could have been greatly extended, if the effort had been made.

It must be recognized, of course, that there were at the same period many educational leaders who remained unconvinced, just as there are some even today who seem to yield grudgingly to the pressure of public demand and the forces of progress. The apathy, lip service, misrepresentation, and ignorance of the critics of industrial arts, through the years have contributed more to the re-examination of objectives and methods, to efforts in the direction of improvement and the elimination of mistakes, and to clarification of the place of industrial arts in the scheme of education, than they have to delaying or sidetracking the movement. There is considerable evidence to support the view that the industrial-arts movement, as we know it today, has developed consistently, and about as rapidly as the supply of adequately prepared teachers permitted.

Further, it seems interesting to speculate on the question as to whether equally instructive and significant expressions of opinion concerning the educational values of industrial-arts instruction in the 1950's could be secured from leading men occupying positions in public life today corresponding to those occupied in the early 1900's by the men who were responsible for the pronouncements cited herein.

Values Sought in the 1880's

It is instructive to examine the concepts of manual training in the early 1900's, as reflected in the letters written by educational leaders from which the foregoing quotations were taken, in relation to statements of aims and values put forward by the pioneer leaders of the 1880's at the inauguration of the movement. To this end, the following paragraphs are adapted from statements attributed to Dr. Runkle, Dr. Woodward, and other spokesmen of that period, and assembled by Bennett in his account of the origin and early development of manual training in the United States.[6]

The introduction of the manual element into our system of public education is justified solely on the broad ground of its educational value to all. . . . It is plain (for example), that if all were taught drawing, not more than one in a hundred would ever practice the art as a livelihood . . . a study of no value to them, if it cannot be so taught as to be justified on purely educational grounds. . . .

The manual training school owes its existence to the conviction that the interests (of the public) demand for young men a system of education which shall fit them for the actual duties of life in a more direct and positive manner than is done in the ordinary American school. . . . It is important that we keep their probable lifework in view in providing for their education. . . . Some of the best friends of education agree in the conclusion that the main deficiency is in the direction of manual education. . . .

The instruction (in the various lines of shopwork, carpentry, foundry work, machine shop, and others) is of direct use to those who will later be employed in any of these occupations. . . . The general training of the hand and eye gives a dexterity and accuracy which lie at the foundation of all good and profitable work. In all the arts the hands must be used as well as the brain, and the handling of tools gives a more practical control

[6]Bennett, *History, op. cit.* Chapter 9, The Early Development of Pedagogically Organized Shopwork Instruction, and Chapter 10, Manual Training in Secondary Schools, pp. 310–401.

of the muscles than gymnasium exercises, or no exercises at all. . . .

It is important that right habits be formed, and that the boy should use his muscles to some purpose instead of working at random. Training in the use of tools affords good mental discipline aside from its everyday, practical use. . . .

A graduate of the manual training school, after two years of practice and related studies under this method, with one year of experience in the trade which he may select, is better qualified than by an actual apprenticeship of five years, with the immense additional gain of studies and drawing which have accompanied his course in practice, and the broad and varied character of his training which render him independent of the precarious demands of any one trade. . . .

Woodward's vision was of shopwork being placed on the same educational plane with other school subjects. He saw the mechanic arts analyzed, pedagogically organized, and taught under the guidance of the same principles that have influenced methods of teaching the sciences, mathematics, and even the languages. The mechanic arts so taught were not to teach trades. . . . He suggested that we have failed to realize all that is included in "education." In our desire to eliminate narrow utilitarian motives, we have run to the other extreme, and have excluded from the schools important and essential branches of study, because they were suspected of being useful. . . .

Although the students work in the shop no more than four hours a week, the experience is valuable. It is not supposed, of course, that skilled work can be produced by this method, but it is certain that such training will make better judges of workmanship. . . .

Runkle built a group of shops to teach the mechanic arts just as laboratories are constructed and equipped to teach physics or chemistry. . . . This discipline should be made a part of general education, just as we make the sciences available for the same end through laboratory instruction. . . . The method is not only educational, but it constitutes the only true and philosophical key to all industrial education. If we can formulate into an educational method the arts which apply in any particular industry, we have only to group about these art courses such other subjects of study as obviously pertain to this industry to have a scheme which shall most surely and directly fit the student both in theory and practice to enter upon its pursuit. . . .

The principal aim (of a given course in manual training) is the acquiring of manual skill in the art. . . . Speed in material production is not a consideration; the whole effort is on learning the art so thoroughly and quickly as possible. . . . The *method* of doing a piece of work, and not the finished piece, is the object of a lesson. . . .

The scope of a single trade is too narrow for educational purposes. Manual education should be as broad and liberal as intellectual. . . . If the object of the shop is education, a student should be allowed to discontinue any task or process the moment he has learned to do it well. . . . The idea of a school is the intellectual and physical growth which comes from the exercise. . . .

So, in manual education, the desired end is the acquirement of skill in the use of tools and materials, and not the production of specific articles; thence we abstract all the mechanical processes and manual arts and typical tools of the trades and occupations of men, arrange a systematic course of instruction in the same, and then incorporate it into our system of education. Thus, without teaching any one trade, we teach the essential mechanical principles of all. . . . The aim is to master the range of every tool and to cultivate the habit of analyzing complicated processes into simple elements. . . .

The manual training school is a school for general training. It is assumed that pupils are too young and undeveloped to decide the all-important question of an occupation or life career. . . . The conclusion, based upon observation, is that not only does manual training not detract from the interest boys take in books, but it stimulates and increases it, either directly or indirectly. . . .

Our public schools do not propose to train their members directly for the practice of any trade or profession. They propose to do much more than that to give to the children the opportunity of obtaining that knowledge and that cultivation of mental powers which will, in due time, bring them to the various occupations of life, ready to pursue them in the most intelligent and most productive manner. . . .

Aims of Manual Training in the 1880's

The following condensed statement of the aims of a manual training school dates from 1887:

1. To inculcate a correct knowledge of the use and care of woodworking tools.
2. To implant the habit of carefulness in accomplishing work.
3. To develop the power to plan work.
4. To teach quickness of perception; to train the judgment; to render the memory exact and reliable.
5. To turn the pent-up energies of the boy into channels of usefulness.

Confusion of Thought

The first point to be made in connection with an examination of the foregoing more or less unrelated statements concerning concepts of manual training in the 1880's is what we would today consider lack of clarity and consistency. The authors of these statements did not seem to appreciate fully the difficulties involved in the defense of manual training for its general educational values, which should be provided for every individual, while at the same time urging its extension in the public schools because of its direct contribution to the training of skilled mechanics in the various trades.

In the second place, it is to be observed that the argument for manual training in the beginning included certain concepts which, two or three decades later, were put forward by the advocates of vocational industrial education. However, it seems clear that the confusion between general educational and vocational educational aims was not shared by all the leaders of that early period. And, as the years passed, and experience with the new program in its various phases accumulated, it became evident that if shop instruction is carried far enough to have genuine vocational values for the students enrolled, it ceases at some point to merit the claim for demonstrable general educational values for all sufficient to justify the time and expense necessary.

Current Ideas of Values

The next step is to examine an authoritative statement of the underlying philosophy of industrial arts as it prevails today, and

to trace the relationships between the concepts of the 1940's and those of the 1900's, and those of the 1880's. For comparison with the foregoing pronouncements, one of the best statements of the current point of view may be constructed from the Report of the AVA Committee.[7]

Industrial-arts courses are part of general education and do not have a distinctly bread-and-butter justification. They are assumed to generate sympathetic interest in the whole of industry, as compared or contrasted with agriculture, homemaking, commerce, and certain technical professions. Instructors in this field aim at broad, rather unspecialized, and often remote values. They consider their subjects and their associations with pupils to be largely informational and inspirational. They do not strive to present all the fields and processes of industry, nor to have pupils attain salable abilities in trade pursuits. They seek merely to sample and explain the mechanical world to young people in the hope of developing industrial and social intelligence rather than technical efficiency. These teachers attempt to provide for their pupils such experiences, knowledges, and insights as will help them to meet the demands of average living and of any calling. They desire, particularly, that their pupils will understand themselves better during the time of occupational choice, and that they will grow in self-expression and in the development of hidden talents. . . .

The meat of the whole matter is that industrial-arts teachers desire to make *worthy changes* in their pupils, changes which may be roughly classified as *doing*, *knowing*, and *being* improvements.

Industrial-arts teachers aid their pupils to acquire some elementary skills by training them in the doing of some mechanical things. By the use of tools, machines, and materials, they supervise construction and repair. Whatever the philosophy or the method of their endeavors, there is always the physical product. The exercises, projects, and jobs are merely vehicles in a scheme whereby doing and planning abilities are developed. . . .

Industrial-arts teachers aid their pupils to acquire considerable amounts and varying types of useful information. Using the same methods and devices employed by other teachers, they lead their pupils to know many things that are either necessary to the work in hand or broadening and cultural in effect. . . . There is a growing tendency to increase the time and attention given to the informative side of industrial-arts instruction. . . .

In addition to pupil changes of *doing* and *knowing* kinds, the well-prepared industrial-arts teacher devotes himself to creating appreciations and enthusiasms for the finer things of life. He has high hopes for his pupils, particularized in terms of their self-reliance, co-operation, pride in workmanship, and dependability. He gives special attention to the development of commendable attitudes and habits, and he knows that his teaching environment is well adapted to the realization of such aims.

Vocational Values

Examining this statement of the current point of view, it may be observed that one of the prominent distinguishing characteristics is the complete lack of disposition to claim vocational values as one of the major outcomes of industrial-arts experiences. The possession of vocational values is not denied, nor is the significance of such values minimized or sought to be eliminated. It is simply accepted that the experiences provided by a well-organized program of industrial arts, even when pursued no further than is warranted by emphasis upon general educational values, *may have* genuine vocational values for certain individuals, depending upon what these individuals do with the results of these experiences later.

Variety of Experiences

Another highly significant distinguishing feature of industrial-arts instruction today is the emphasis on variety of experiences with tools, materials, and processes of construction. This development is consistent with the most advanced thinking of the psychologists. We not only learn by doing; but, since life consists largely of making the best decisions in meeting situations, the ability to meet and cope with situations is developed by experience in meeting and coping with the widest possible variety and greatest possible number of situations. The attainment of this ideal is complicated by the grave risks of superficiality involved. This is one of the vital problems of the industrial-arts instructor today.

Again, the emphasis upon abstract exercises, the making of "joints," and the like, which was characteristic of the early manual training, was already beginning to disappear in the early 1900's, as indicated by certain statements cited herein. The industrial-arts instructor of today occasionally finds a place for an exercise piece to meet a particular need, in much the same way as "drill" is occasionally called for in other school subjects. It is recognized for what it is, a means to a definite end, and by no means an end in itself.

Development of Desirable Habits

The industrial-arts instructor of today, with the approval and support of the psychologists, regards the development of desirable habits as among his important responsibilities. The emphasis, however, is not so much upon the importance of the habits themselves, as upon the contribution which the possession and practice of desirable habits makes to the production of a well-rounded personality.

The manual-training instructor of an earlier period was persuaded that habits developed through the manipulation of tools and materials in the school shop would automatically find applications wherever they might be needed or useful. The industrial-arts instructor of today knows that specific habits tend to express themselves in general applications only if they are consciously woven into an integrated and well-balanced personality, capable of recognizing the appropriate relationships.

The serious student of educational theory and practice will be well rewarded by the further examination of the evolution of thought concerning handwork experiences in the schools which has taken place from the 1880's to the 1900's and to the 1940's.

The industrial-arts instructor of the 1950's has reason to be proud of the heritage that has come down from the early leaders; he may well be inspired by the recognition that has been accorded the work to which he is devoting his life; he should be determined to contribute his full share to maintaining and strengthening the place of industrial arts as an indispensable and integral part of a complete and unified program of general education.

The End

[7] *Improving Instruction in Industrial Arts.* A Revision of the AVA Bulletin on Standards of Attainment in Industrial-Arts Teaching. Report of the Committee, Dr. Homer J. Smith, chairman. American Vocational Association, Washington, D. C., June 15, 1946, pp. 12–14.

Industrial Arts and Vocational Education
John J. Metz, *Editor*

INDUSTRIAL ARTS AND THE EMERGENCY

At the present time, when we are told that we are not in a state of war, when civilian goods in many lines are more or less severely limited, when numerous factories are devoted entirely to the production of war material, when, above all, our boys are being slaughtered in large numbers, it may be time for the teachers of industrial arts to review their work and see what can be done to make their offerings more nearly fit present needs.

In World War II, we were told again and again that boys and men who have industrial-arts training at some time in their lives, were much easier to train for defense training jobs, than those who did not have this type of training.

With this in mind, can we plan our industrial-arts offerings now so that our students come somewhat nearer to receiving training that has real life adjustment value — not only for the emergency but for peace time also.

What will that mean for our present industrial-arts curriculum? Probably not as much as most teachers may think. But it will mean, in most cases at least, a shift of emphasis in a number of phases of work in which we are engaged at present.

One of the points of emphasis should be skill. In manual training days, skill may have been overemphasized. Then, in later years, it was almost totally overlooked. This must be changed again. The student must not only know how to use a tool, but he must know how to use it well. Of course, you may answer, is not that an objective of vocational and trade education? It certainly is, but many industrial-arts teachers do not stress skills as much as they ought so that students get a very hazy idea of the necessity of doing work skillfully and well.

Safety work is being stressed more and more in industry. Many industrial-arts teachers do remarkably fine work in teaching their students to work safely. But, there again, other teachers do not emphasize it enough with the result that students leave our shops, especially those where handwork is done, with but a meager idea about working safely.

Another point that needs more emphasis is a knowledge of materials. The students should be initiated in the use of as many types of materials as possible. A general shop — the laboratory of industry — will greatly assist in disseminating this kind of knowledge. It will help the student to know where to use the various types of lumber, nails, screws, bolts, sheet metals, band iron, and the like. He should also know what tools are to be used in working with the various kinds of materials, so that he not only knows how to use woodworking tools efficiently, but is conversant also with a few of the more commonly used hand tools used when working with metals.

Boys who have learned to use a number of the power tools are in a still better position to show what the elementary and high school shops are doing for the youth of America, and what industrial arts in the schools can accomplish for the national defense.

THE GREAT LEONARDO DA VINCI

April 15, 1952, marked the celebration of the 500th anniversary of the birth of Leonardo da Vinci, the great Italian painter, sculptor, naturalist, architect, musician, goldsmith, mathematician, student of applied science, and mechanical, civil, and military engineer.

Studying the life of this great and versatile man makes one wonder what this genius would have accomplished if he had had the opportunities now enjoyed by those who study at our universities and have access to the products of modern science.

When Leonardo was about eighteen years old, he was placed under the guidance of Andrea del Verrocchio, who himself was quite a noted goldsmith, painter, and sculptor. He worked with this master for about seven years and was entrusted to assist at some of Verrocchio's most important works. By 1478 he was accepting commissions as an independent artist. Some of his early pen drawings and sketches are still extant. His ingenuity also got him an appointment at Milan as the master of pageantry, which gave him an opportunity to compose jests, tales, satires, and the like, to be used at the many court festivities.

He cast several huge equestrian statues. Some of those who commissioned him to do such work had reasons to discover that work entrusted to Leonardo was not always produced as quickly as might be expected, because this genius would make innumerable sketches and do much studying before he would begin on a project. It was not unlikely that he might destroy an almost finished piece of work and start all over again.

The fact that many plans are in existence which were drawn by him for the erection of new churches or public buildings, or for altering or beautifying old ones, shows that he also was conversant with architectural and engineering processes.

The painting of the "Last Supper" was started by him in 1494 and was finished in about four years. It is probably his greatest painting.

The Mona Lisa is a portrait of the wife of Zanobi del Giocondo. It was finished during the years 1503–06.

He is the author of a book *Treatise on Painting* which gives practical directions to painters. Many of his notebooks are lost and others are scattered over a number of European museums.

He was indeed a very versatile genius, and is a worth-while example to set before the boys and girls who are now living in this age of mechanical, electrical, and chemical wonders.

YOUR ADDRESS FOR THE SCHOOL YEAR 1952–53

May we call your attention once more to the fact that copies of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION that go astray because of being sent to addresses that are no longer correct cannot be replaced.

Press runs must be kept as low as possible because of increased material and labor costs. For this reason please send your new address, your zone number, and your previous address to our circulation department no later than August 15.

Women in Industry

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The Factory Workers of Lowell

The influx of women into industry is no phenomenon of the modern day. It began in this country between 1825 and 1830 in the cotton mills of New England. Prior to this time women had worked in the homes and on the farms. They had done needlework and teaching, but they had done little else. There was little else to do, little else that was open to them, and the introduction of the factory system, with women forming the larger part of the working personnel, was truly a revolution.

For some time, during the period between 1800 and 1825, a number of New Englanders had been searching for some other means of investing the wealth that had derived from the shipping trade. The War of 1812, with its resultant blockade and the previous embargo which had closed the ports to shipping, had dried up the sources of profit. It was but natural therefore, that other means of investment should be sought.

The great cotton manufacturing industry of the English cities of Manchester and Leeds had attracted the attention of a number of New Englanders, among them Francis C. Lowell and Patrick Jackson. Lowell was especially interested and made a trip to England to study the industry and the machinery at firsthand. This study, which was necessarily somewhat secretive, together with conversations with such factory technicians as he could prevail upon by a bit of judicious bribery to impart information, served still further to encourage Lowell to continue his efforts.

Returning to this country, Lowell set about improving certain processes and mechanical features and, as Appleton points out:

> Mr. Lowell adopted an entirely new arrangement, in order to save labor, in passing from one process to another and he is unquestionably entitled to the credit of being the first person who arranged all the processes for the conversion of cotton into cloth, within the walls of the same building.[1]

Lowell and his partner, Patrick T. Jackson, established the first cotton mill — incorporated for $400,000 and featuring the power loom — at Waltham, Mass., in 1813. The mill was an immediate success and subsequently Jackson and several other persons began looking about for another site upon which to establish a similar mill. Naturally, this had to be done more or less secretly in order to prevent the owners of prospective sites from asking exorbitant prices for their lands.

Kirk Boote was appointed agent for the comtemplated new corporation and after much investigation — and not a little chicanery — purchased land on the Merrimack* River near Pawtucket Falls. In order to secure the land from the shrewd farmers in the neighborhood of Pawtucket Falls, Boote pretended that he wanted the land for orchards. Later some orchards were actually planted, but for some time after the deal songs were sung and jokes were cracked at the expense of the farmers who parted with their lands at prices far below what they could have obtained. Boote's real reason for his selection was the water power that was available, but he quite naturally kept this a secret and thus was able to buy an excellent site at a very nominal price.[2]

> Finally, Pawtucket Falls, on the Merrimack River, was selected as a possible site where a large manufacturing town could be built up. Here land was bought, and the place, formerly Chelmsford, set off in 1826, was named Lowell, after Francis Cabot Lowell, who, through his improvements, was practically the inventor of the power loom, and the originator of the cotton cloth manufacture as now carried on in America.[3]

The introduction of the cotton manufacturing industry into America was not accomplished without a certain amount of trepidation on the part of those individuals whose money was being risked in the venture. Study of the industry in England had revealed certain undesirable features as well as certain desirable ones. In the first place, one of the reasons which encouraged these entrepreneurs to establish factories was the availability of a large potential labor supply, potential because there was much doubt as to its actual availability.

> There was little demand for female labor, as household manufacture was superseded by the improvements in machinery. Here was in New England a fund of labor, well-educated and virtuous.[4]

The budding industrialists of New England were all too well aware of certain features of English industrialism, however, and pondered long upon the problems involved.

> The introduction of the cotton manufacture in this country, on a large scale, was a new idea. What would be its effect on the character of our population was a matter of deep interest. The operatives in the manufacturing cities of Europe were notoriously of the lowest character, for intelligence and morals. . . . We could not perceive why this peculiar description of labor should vary in its effect upon the character from all other occupations.[5]

Obviously there was no desire to have emulated in New England the undesirable features which were inherent in the European system. Steps were taken, therefore, to devise an atmosphere which would attract to the factories individuals of a relatively high type. The factory owners were desirous of securing as their employees the wives, sisters, and other female relatives of their neighbors. Naturally, these industrial pioneers would have found it difficult to attain this aim unless the work and the surroundings were made both attractive and respectable. And, unless they did attract the women of the better class of families, they would be compelled to fall back upon the types of workers so

[1] Appleton, Nathan, *The Power Loom and the Origin of Lowell*, p. 14.
*Original spelling.
[2] Robin, Harriet H., *Loom and Spindle*, p. 7.
[3] *Ibid.*, p. 8.
[4] Appleton, Nathan, *Introduction of the Power Loom and the Origin of Lowell*, p. 15 f.
[5] *Ibid.*, p. 15.

prevalent in the European factories. It was either that or abandon their plans entirely.

> . . . the founders looked for a remedy for this defect. They thought that education and good morals would even enhance the profit, and that by introducing a more cultured class of operatives they could successfully compete with Britain. For this purpose they built boarding houses, which, under the direct supervision of the agent, were kept by discreet matrons, mostly widows, no boarders being allowed except operatives.[6]

Appleton corroborated Watson's statements and further indicated the beginning of a new philosophy regarding the employment of women in factories:

> It was not perceived how a profitable employment has any tendency to deteriorate character. The most efficient guards were adopted in establishing boarding houses, at the cost of the Company, under the charge of respectable women, with every provision for the religious worship. Under the circumstances, the daughters of respectable farmers were readily induced to come into these mills for a temporary period.[7]

Perhaps two things need some explanation in the above statements. First the fact that daughters "of respectable farmers" were prevailed upon to accept employment in the factories is proof that the mills must have been different from any previous types of industrial enterprise. The rural population of any country is inclined to be the most conservative and the most God-fearing. That farmers permitted their daughters to enter the mills is proof that the factories engaged in the manufacture of cotton goods must have been on rather a high plane.

The other point that needs some clarification is that pertaining to coming into the mills "for a temporary period." As will be shown later in this paper, the temporary period is more or less a relative term. The girls came to work for various reasons and stayed for varying periods of time. For the most part, however, they averaged not less than three years.

Once the pattern was established and it became respectable for women and girls to work in cotton mills, Lowell began to grow tremendously. In 1828 there were approximately 3500 persons living in Lowell; two years later this figure had nearly doubled. Of the former figure almost half, 1500 girls, were employed in the mills.[8]

The establishment of the cotton mills in Lowell was a boon to that section of New England. Girls and women came from many points — no easy task in those days of inadequate means of travel — to work in the mills. The opportunity to work under pleasant conditions and to live in cheery surroundings, to associate with those of their own age and thus to exchange ideas and points of view, must have seemed a heaven-sent opportunity, indeed, to the girls from New England's farms and villages. Then, too, the chance to earn their own living and thus to be more or less independent was not without its attractions to those whose opportunities for employment had previously been narrowly circumscribed.

As has been said earlier in this article, before the introduction of the cotton mills into New England women worked in the homes and on the farms, they did needlework or taught school, or, in some cases, they kept boarding houses. It was not uncommon for unmarried daughters, widowed daughters, sisters-in law, and other female relatives to be dependent for their livelihood upon the bounty of some man. This was inevitably the cause of bitterness in any number of cases.

There were, of course, other reasons why girls and women came to work in the mills. Life in New England has never been easy. Wresting a living for a family from the barren acres occupied nearly all of a man's time and effort. There was little ready money with which to relieve the hours after toil was over for the day. There was little or no money which might be spent on any except the absolute necessities of life. When a daughter or some other female relative left home to work in the cotton mills, the money which she invariably sent home did much to relieve the hardship and to add to the comfort of the family.

> Into the barren homes many of them had left, it went like a quiet stream, carrying beauty and refreshment. The mortgage was lifted from the homestead; the farm house was painted, the barn rebuilt; modern improvements, including Mrs. Child's *Frugal Housewife*, were introduced into mother's kitchen, and books and newspapers began to ornament the sitting room table.[9]

This, however, was not the only reason why women entered the mills. Indeed, it was not even the main reason, if an early writer on the subject is to be believed. The traditional New England respect for, and the determination to have, education seems to have been the chief basis for accepting employment. It worked in two ways: first, it enabled these women to finance the education of some male member of their family; second, it permitted them to advance their own education.

> The most prevailing incentive to labor was to secure the means of education for some *male* member of the family. To make a *gentleman* of a brother or son, to give him a college education, was the dominant thought of a great number of the better class girls.[10]

Working in the cotton mills afforded to the operatives an opportunity to enhance their own education. The owners of the mills early established circulating libraries in which, for six and a quarter cents a week, the novels of Richardson, Madame D'Arblay, Smollet, Cooper, Scott, and Captain Marryatt "could be devoured."[11] In many cases the older girls passed on the books to those among the younger girls who could not afford even this modest rental. With access to books such as they never could become familiar with in their own homes, it was but natural that on this score alone there would be some inducement to seek employment in the mills.

An early New England writer who has already been quoted, Harriet Hanson Robinson, worked in the mills during her girlhood. She has given us in several of her books a firsthand picture of the working conditions in the mills and of the lives of the girls who worked in them. The picture is remarkably clear and detailed, and seems to reflect little of a deleterious nature in these early industrial beginnings. The hours were long as was the custom in those days, but the work was performed on a very leisurely basis. No doubt the fact that the operatives were for the most part women had much to do with this condition. The overseers and owners seem to have had the welfare of their employees at heart — as has already been indicated — and there is a wealth of evidence that they concerned themselves with establishing and maintaining conditions which were to be to the benefit of their employees.

> The early mill girls were of different ages. Some . . . were not over ten years of age; a few were in middle life, but the majority were between the ages of sixteen and twenty-five. The very young girls were called "doffers." They "doffed" or took the full bobbins from the spinning frame, and replaced them with empty ones. These mites worked about fifteen minutes every hour, and the rest of the time was their own. When the overseer was kind they were allowed

[6] Watson, A., *Handbook for the Visitor to Lowell*, p. 31.
[7] Appleton, Nathan, *Introduction of the Power Loom and the Origin of Lowell*, p. 15 f.
[8] Bartlett, Elisha, *A Vindication of the Character and Condition of the Females Employed in the Lowell Mills . . . .*, p. 9 f.
[9] Robinson, Harriet Hanson, *Early Factory Labor in New England*, p. 11.
[10] *Ibid.*, p. 11.
[11] *Ibid.*, p. 10.

to read, knit, or go outside the mill yard to play.[12]

Later on legislation was to affect the employment of the children under 15 years of age for more than nine months of the year, but at the time Mrs. Robinson was employed in the mills such protection was not in effect. Nevertheless, it does not seem from her statements that the children were worked unduly hard, though it must be admitted that the hours were long.

> The working hours of all the girls extended from five o'clock in the morning until seven in the evening, with one-half hour each for breakfast and dinner. Even the "doffers" were forced to be on duty for nearly fourteen hours a day.[13]

A 14-hour working day for a youngster under ten years of age would inevitably have had a deleterious effect so far as the health of the youngster was concerned. As this would naturally have led to criticism in the community, it is not to be wondered at that the little doffer "was permitted to read, to knit, or to go outside the mill yard to play."[14]

The same consideration which was shown for the doffers was extended to the other girls as well. They were not driven during their work, but took their own time, set their own pace, and took their workaday life in a leisurely manner. The girls kept their own accounts of piece work, their figures were accepted, and they were paid accordingly.

There was a feeling of mutual respect and equality between the operatives and their employers and overseers. So excellent, indeed, was the reputation enjoyed by the operatives that a number of authors have commented upon the fact that from all over New England young men came seeking wives in Lowell. There may have been several other factors involved in this phenomenon, however. The fact that there were probably more girls gathered together in Lowell, and the fact that most of them had managed to assemble a very respectable marriage dower, may have played a not unimportant part in causing young men to come flocking to the thriving city established on the shady banks of the Merrimack.

By 1832 the factory population of Lowell was well established. It was divided into four classes: The agents of the corporations, the overseers — ambitious mill hands who had worked themselves up from the lowest grades of factory labor — the operatives, always spoken of as "girls" or "men," and the laborers. This fourth class, frequently referred to as "the lords of the spade and shovel," consisted for the most part of Irish immigrants. They furnished the labor by which the factories were erected; their children often became valuable operatives.[15]

Perhaps it is this latter fact, together with the one referring to the rise of the overseers from the status of operatives, which led one author to comment thusly:

> This process has been repeated, the destiny of the factory being ever to reach down and lift people up out of lowly into higher conditions.[16]

It would seem, then, that the coming of the cotton mills to New England was an asset spiritually, educationally, financially, and maritally. It is not to be thought, however, that the movement was entirely without criticism. Two Boston publications, *The Boston Times* and the *Boston Quarterly Review*, published a series of articles in 1841 purporting to expose the deplorable conditions supposedly existing among the operatives who worked in the Lowell mills.

After waiting until the series was concluded, Dr. Elisha Bartlett, a physician living in Lowell, published a refutation of the charges. He made it quite clear in his introduction that he was in no way connected with any of the mills, that he held no stock in them, and that, therefore, he was in a position to present unbiased data.

To the charge of the Boston authors that the operatives were compelled to live in the corporation boarding houses, Dr. Bartlett replied thus:

> This is no very grave matter. . . . It is partly true and partly false. On some of the corporations the requisition is made, in others it is, if not in the letter, in spirit and practice, wholly disregarded. Some of the mills are in the midst of private boarding houses, and some of the hands employed live in these; large numbers board away from the corporations. The average number of girls employed in the Boott mills is 900. On the first of April, there were 236 boarding out of the corporation. Others, especially Merrimack, Tremont, Suffolk, and Lawrence, are quite removed from any private boarding house and here nearly all the hands live in the houses belonging to the mills.[17]

No further comment seems necessary regarding the first charge.

The second charge had to do with the character of the women who kept the boarding houses, and though this has already been dwelt upon briefly, it would seem to deserve further comment. On this score Bartlett reported as follows:

> I have a few words to say of the people who keep the female boarding houses. Most of them are, to be sure, in moderate or humble circumstances: some of them have seen better days. A few have husbands, but a great proportion are widows — some with small families, and others without. But they are uniformly — almost without exception, women of perfectly correct moral deportment. The enquiries of the agents into their standing and character are careful and particular, and these enquiries must be satisfactorily answered before they can be admitted to the houses, and the same good character must be sustained or they cannot remain there. These women constitute a remarkably permanent part of our population.[18]

Probably one of the most serious charges to be made against the corporations had to do with their treatment of the operatives. The public was led to believe that conditions in the mills were so detrimental to the health of the girls that their average useful life was three years. After that the mills were pictured as heartlessly turning the poor creatures out to wander back home to die. Bartlett conducted a survey among the operatives of a number of corporations in Lowell. He found, in answer to the questions of whether the girls found their health better, as good, or poorer than when they began work, that in one mi[ll] 41 girls out of 55 said that their health was as good as when they had begun work. Three claimed that their health was better and eleven claimed that it was poorer. Of these eleven an overseer commented that six looked healthy and "rosy" and that five looked "pale." In a number of the other mills Bartlett found that the proportions ran about the same.[19]

These results were obtained from girls who had worked three or more years in the mills and whose ages averaged 18 years. As Bartlett remarked regarding the charge relative to the detrimental effects upon the health, spirits, and morals of the operatives: "Out upon such abominable trumpery!"[20]

Bartlett's comments were not lacking in humor and his observations on the foibles of the mill girls afford an interesting insight regarding the women of the period. He recommended that each girl provide herself with an umbrella, India rubber overshoes, woolen stockings, and flannels for winter instead of:

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[12]Robinson, Harriet Hanson, *Early Factory Labor in New England*, p. 6.
[13]*Ibid.*, p. 6.
[14]Robinson, Harriet Hanson, *Early Factory Labor in New England*, p. 7.
[15]Robinson, Harriet Hanson, *Loom and Spindle*, p. 15.
[16]Wright, Carroll D., Introduction to *Loom and Spindle*.
[17]Bartlett, Dr. Elisha, *A Vindication of the Character and Condition of the Females Employed in the Lowell Mills* . . . , p. 6 f.
[18]*Ibid.*, p. 8.
[19]*Ibid.*, p. 10 f.
[20]*Ibid.*, p. 11.

. . . sacrificing to her pride in the form of silk stockings, parasols, lace veils, and kid shoes.[21]

His comments have a strangely familiar ring and might easily be applied to the dress of present-day women in industry.

In further rebuttal regarding the morals of the operatives, the good doctor pointed out that only by maintaining an unsullied reputation was it possible for a girl to maintain her position. He insisted that the best means of retaining a moral atmosphere was in the hands of the girls themselves because they maintained a "jealous and sleepless watchfulness" over each other.[22] Apparently there was a certain amount of competition for the young men who came to Lowell looking for wives.

The conclusion that Bartlett reached was that:

> The great body of girls are as virtuous as the female population of any part of New England.[23]

Other charges were included in the list published by the two Boston publications, but these were of a minor character and were apparently easily refuted by Bartlett. No consideration will be devoted to them here as they can have little interest.

In conclusion, then, it would seem to be the opinion of an overwhelming number of qualified individuals, including several former operatives, disinterested outsiders, and observers in general, that the coming of the factory system to New England was productive of good rather than bad effects. It is certain that the coming of the cotton mills created a change in the thinking so far as it applied to women seeking employment outside the home. From teaching, needlework, and bookbinding to the operations of machines in factories and living in boarding houses was a long step. It was a step which occasioned much sober consideration on the part of those who wished to bring in the factories and of those whose female relatives were to form the labor supply.

Finally, the step having been taken, New England was launched firmly upon an industrial era. From that era it never returned to the old agrarian economy. In the train of this industrialism came money to make New England farm homes more livable, money for dowers for New England girls, an influx of immigrants, and increase in the literacy of the population, and development such as New England had not seen in the one hundred years previous to 1825. It can truly be said, then, that the coming of industrialism changed the entire course of history not only for New England, but for the rest of the country as well.

[21] *Ibid.*, p. 13.
[22] *Ibid.*, p. 17.
[23] *Ibid.*, p. 17.

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PROBLEMS AND PROJECTS

WHAT TO DO WITH THE SCRAPS

JOHN J. DeFOURNY
Crestview Junior High School
Columbus, Ohio

Scraps are an inevitable product of the industrial-arts classes. In some part of every shop there is a container for the pieces left over after a project has been constructed. This container, even though it is periodically emptied, gradually fills again and always presents the same question to the instructor — "how can I make use of these scraps?"

Fig. 1. The scrap box

Storage space becomes a great problem to the instructor if he attempts to keep large quantities of scrap in the shop. The instructor realizes that using the contents of the container as kindling wood is wastefulness. He therefore, first examines the scrap pile for pieces that might be used in the shop for smaller projects or as parts of larger projects. This inspection done, the instructor has fulfilled his responsibility of utilizing all the material purchased for the industrial-arts classes.

Assisting the Academic Departments

Outside of the industrial-arts department there are other classes in which what is left of the scrap pile, might profitably be used. Students enjoy making things with their hands, why cannot the English, mathematics, science, and other departments in the school incorporate this means of valid expression in their courses? As a part of functional learning there are some students that can interpret a learning situation more satisfactorily through the skill of their hands. In the writer's school the academic departments have encouraged the students to submit full scale or miniature reproductions to more clearly visualize the subject matter of the courses.

Science:

The science department allots periods for laboratory work. Through this type of a program, the students select topics for discussion in the classroom and for experimentation in the laboratory. One of the examples where the wood scraps have been used by the science department is in the nature study course. During the laboratory periods, the students designed and built birdhouses and feeders. This building of the birdhouses and

Fig. 2. Use of scrap in art room

Fig. 3. Use of scrap in the elementary school

feeders completes a nature course by having the students themselves provide food and protection for the birds in the neighborhood. Other projects constructed by this group are: model water wheels, water troughs, wind gauges, rain gauges, specific gravity blocks, dew point apparatus, and a V center of gravity model.

History:

History can be made more comprehensible if the historical events are re-created by various methods for the students. Besides the methods of dramatic portrayals, recordings, descriptive paintings and photographs, discussions, and books, a miniature model of an important battle ground could be constructed. This model can be simple or complete in detail to include villages and pertinent landmarks. The students of the history classes have made miniature models of ducking chairs and stocks as used during the colonial period. Small scale reproductions of famous ships, forts, homes, and objects that have historical value could be used most effectively by history classes.

English:

To a growing boy a model of a medieval weapon can be a great stimulus to encourage a more comprehensive reading of an assigned story. Scrap wood could be used by the students of the English classes to build small scale sets or objects of famous scenes, plays, or stories in literature.

Languages:

Studying a foreign language requires not only the ability to translate and to speak the language but to have some knowledge of the people and of the country where the language is spoken. A better understanding of these people could be achieved if reproductions were available of their homes, their villages, and of the objects associated with their customs and daily lives.

Mathematics:

Considerable research has been conducted to prove the validity of using visual aids to demonstrate the theories of mathematics. A great volume of commercially produced aids may be purchased for mathematics classes, but the students could make these visual aids without cost by using the scrap wood from the woodshop. Small blocks of wood could be shaped into squares, rectangles, cubes, triangles, cones, spheres, and any other geometrical shape discussed in the course. Another problem that should prove stimulating to a class would be to take the odd shaped pieces found in the scrap box and properly identify them in geometrical terms or to compute the angles, areas, and volumes of each piece.

Assisting the Fine Arts Department

Fine-arts teachers rarely are permitted to requisition wood and metal in sufficient quantity. If the wood and metal departments placed the use of their scraps at the disposal of the fine-arts department there would be examples of the expression of these mediums in various interpretations. Wood, for example, should not be considered strictly a medium for the furniture projects in the woodshop but may be used as decorative objects for the home in the forms of sculpture pieces, abstract paintings on wood, mobiles (mathematical proportioned pieces suspended from the ceiling to present effects), picture frames, or as bases to display the work of the fine arts classes. Figure 2 shows students working on abstract sculpture pieces made in the art classes. To make these abstracts, thoughtful consideration is given to combinations of sizes, shapes, colors, compositions, and to the effectiveness of using different materials together such as wood, metal, wire, string, and textiles. This opportunity to explore various techniques and mediums may be provided for the students of the fine arts department by the scrap box in the woodshop, the metal shop, and the home-economics department. Carving is another art that may be taught through the use of small pieces of wood. A student in the writer's school is developing a strong interest and talent for wood sculpture by working on doing whittling and carving during his fine arts and industrial-arts classes.

Assisting the Elementary Classes

If there are elementary classes in the school, the industrial-arts instructor should encourage their teachers to include woodwork in their program. All elementary classes have a period set aside for craftwork in which the children are permitted to paint, work in clay, build with blocks, or do other things with their hands. If these children had some scrap wood, they could build simple boats, toys, or other projects as described in craft books for the elementary levels. Figure 3 shows the kindergarten class working at the bench in their own classroom. The material used by them is from the scrap box of the woodshop.

Encouraging Home Workshops

After all of the departments have their supply of scraps, there still remains one more source of disposing of what is left of the scraps. This source, which is the students themselves, is more commonly discouraged rather then encouraged. With the stipulation that they come to the woodshop at the end of the school day to avoid having scraps scattered throughout the school building, boys are permitted to go to the scrap box to select small pieces to take home. The boys are asked to show their selection to the instructor and they are asked for what purpose the scraps are being selected. The common response has been that the wood is to be used for miniature houses, stores, railway stations, and bridges for their train sets. Home shop programs are encouraged through this privilege.

Summary

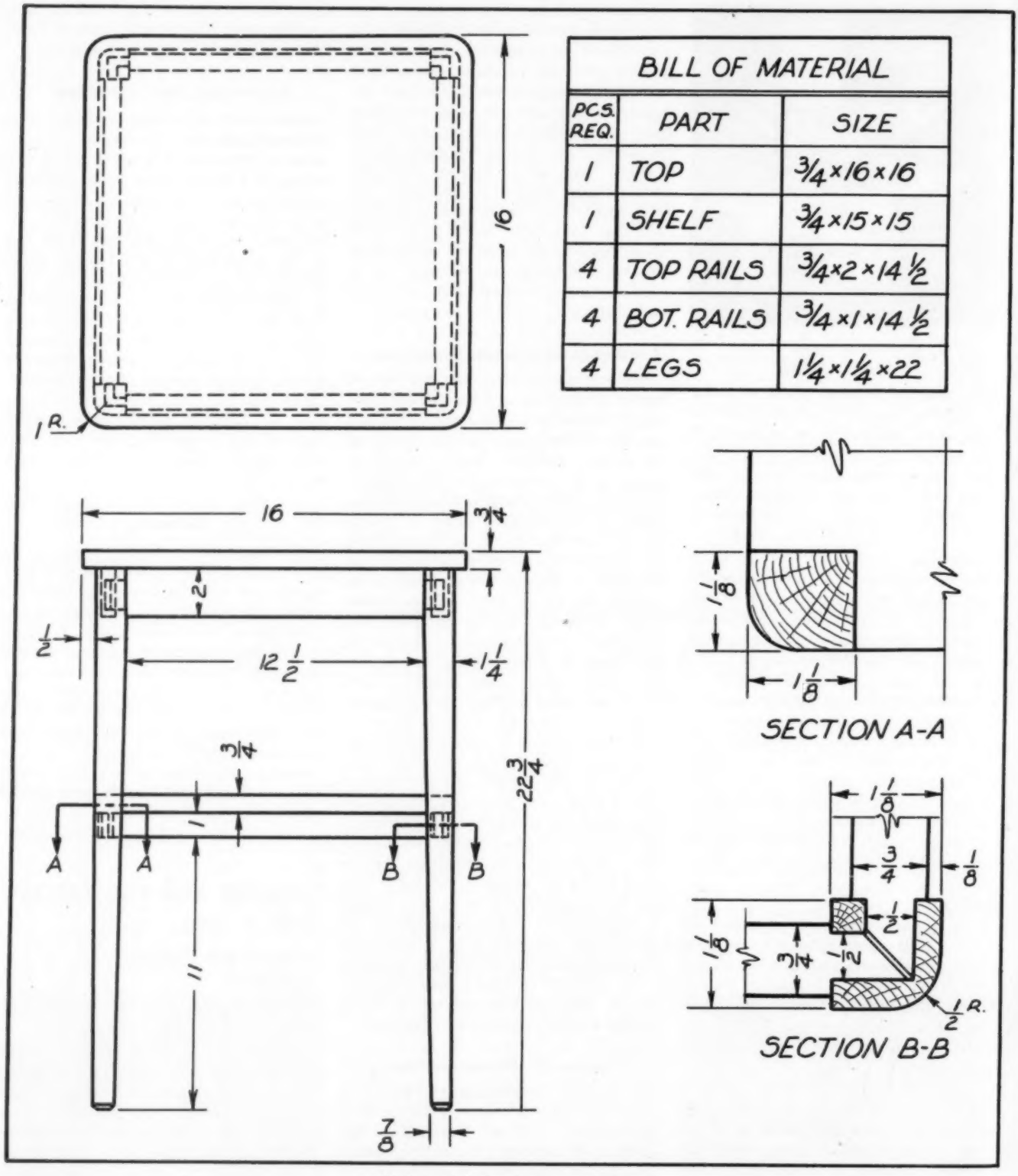
This distribution of the scraps to the various departments can be accomplished with little infringement upon the time of the industrial-arts instructor and upon the cost of the industrial-arts departments. What is scraps to one department constitutes good material for another department. It is discovered that fellow teachers are extremely grateful for this sign of interest in their work and of sharing material. Through such acts the industrial-arts department extends its influence and purposes throughout the school and the home rather then restricting itself to one room in the school building.

COFFEE AND END TABLES

JAMES E. SEITZ
Industrial Arts Instructor
High School
Huntingdon, Pa.

The two tables pictured herewith, because of their simplicity of design, will harmonize with most contemporary furniture. Their simple design makes rapid construction possible, a feature which is especially attractive to the students.

The black walnut lumber used in the tables shown was obtained from planks which were sawed several decades ago. Characteristic of this seasoned lumber is its reddish-brown color and the ease with which it is worked. It takes a finish well also. Anyone who likes woodworking will enjoy a new pleasure



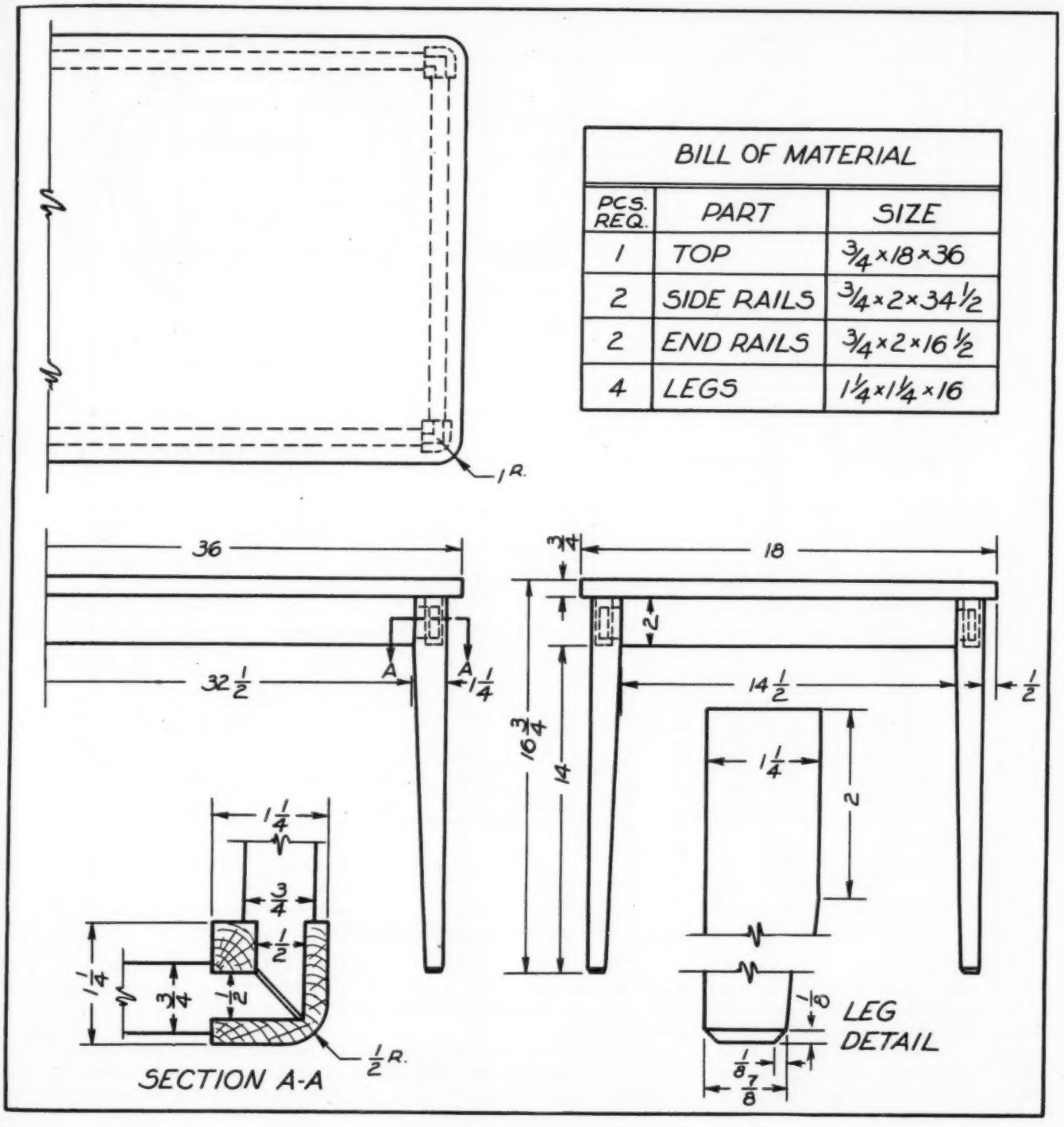
BILL OF MATERIAL		
PCS. REQ.	PART	SIZE
1	TOP	3/4×16×16
1	SHELF	3/4×15×15
4	TOP RAILS	3/4×2×14 1/2
4	BOT. RAILS	3/4×1×14 1/2
4	LEGS	1 1/4×1 1/4×22

Coffee table by James E. Seitz

when he works old walnut for the first time.

To finish the tables, a durable penetrating finish should be used. This finish, easily obtainable from the General Finishes Sales and Service Company, is easily applied and when dry it affords a durable surface which withstands abuse that would mar many other surface finishes.

Although the finish may be mixed with a stain or applied over a stained surface, the tables were given transparent coats to retain the natural color of the wood.



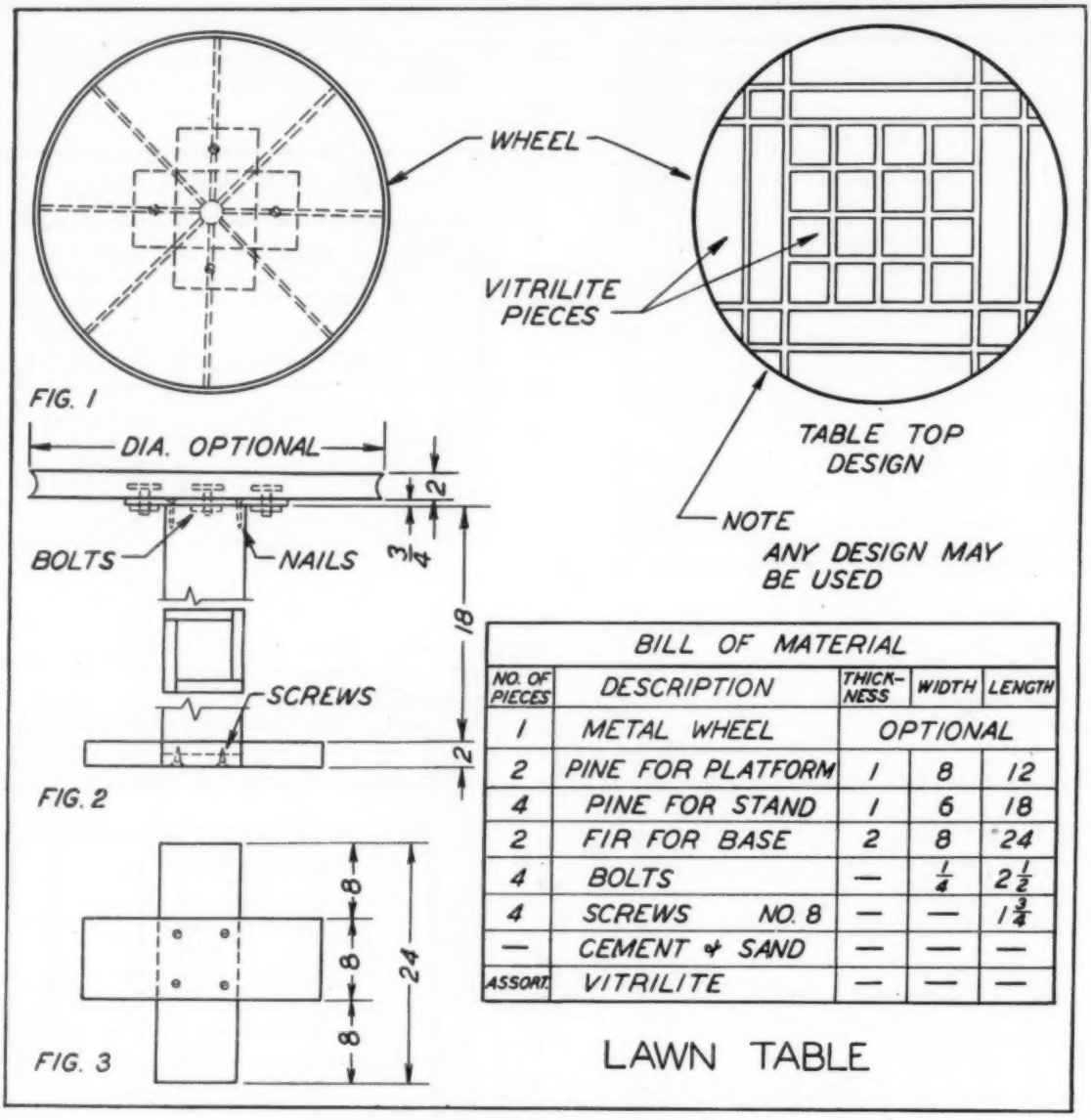
End table by James E. Seitz

CONCRETE LAWN TABLE

ROBERT C. MEDFORD
East Lansing, Mich.

This lawn table, shown in this article, besides being a very desirable school shop project, also makes a good job for the home craftsman. The size of this table is very easily changed to meet the need of the builder and the materials that he has on hand.

The top of the table is a metal wheel 2 inches or less in thickness. A bicycle wheel, or an old plow wheel will do nicely. The wheel should have metal spokes to reinforce the concrete poured in to make the table top. The design on the top surface is made of pieces of vitrilite (building glass) that can be obtained from most glass companies. Broken pieces of vitrilite can usually be obtained at very little cost and the design



BILL OF MATERIAL

NO. OF PIECES	DESCRIPTION	THICKNESS	WIDTH	LENGTH
1	METAL WHEEL	OPTIONAL		
2	PINE FOR PLATFORM	1	8	12
4	PINE FOR STAND	1	6	18
2	FIR FOR BASE	2	8	24
4	BOLTS	—	1/4	2 1/2
4	SCREWS NO. 8	—	—	1 3/4
—	CEMENT & SAND	—	—	—
ASSORT.	VITRILITE	—	—	—

Concrete lawn table by Robert C. Medford

can be varied so as to use many odd pieces.

The stand is made of ¾-in. pine. Other material may, of course, be substituted. It is fastened to the top with ¼-in. bolts 2½ in. long, set in the concrete. The wood and the edge of the wheel may be finished as desired.

The base is made of 2 by 8-in. lumber, fastened together with a lap joint and held in place with No. 8 flathead screws 1½ in. long.

Construction steps:

1. Select metal wheel, place it on a smooth, level surface, and draw around it with a piece of chalk and then remove the wheel.

2. Lay out the pieces of vitrilite *face down* inside of the chalk line, placing them in the desired pattern (pieces may be cut with an ordinary glass cutter). Be sure that none of the pieces touch each other. A few bright metal chips may be sprinkled between the pieces if desired.

3. Place the wheel over the design; be sure that the wheel does not touch any of the pieces.

4. Make a concrete mixture using cement, sand, and water, making it thin enough to pour easily. Pour this into the wheel, filling it full, then level it even with the top of the wheel. Set four bolts into the proper places, as shown in Figure 1, and allow to harden.

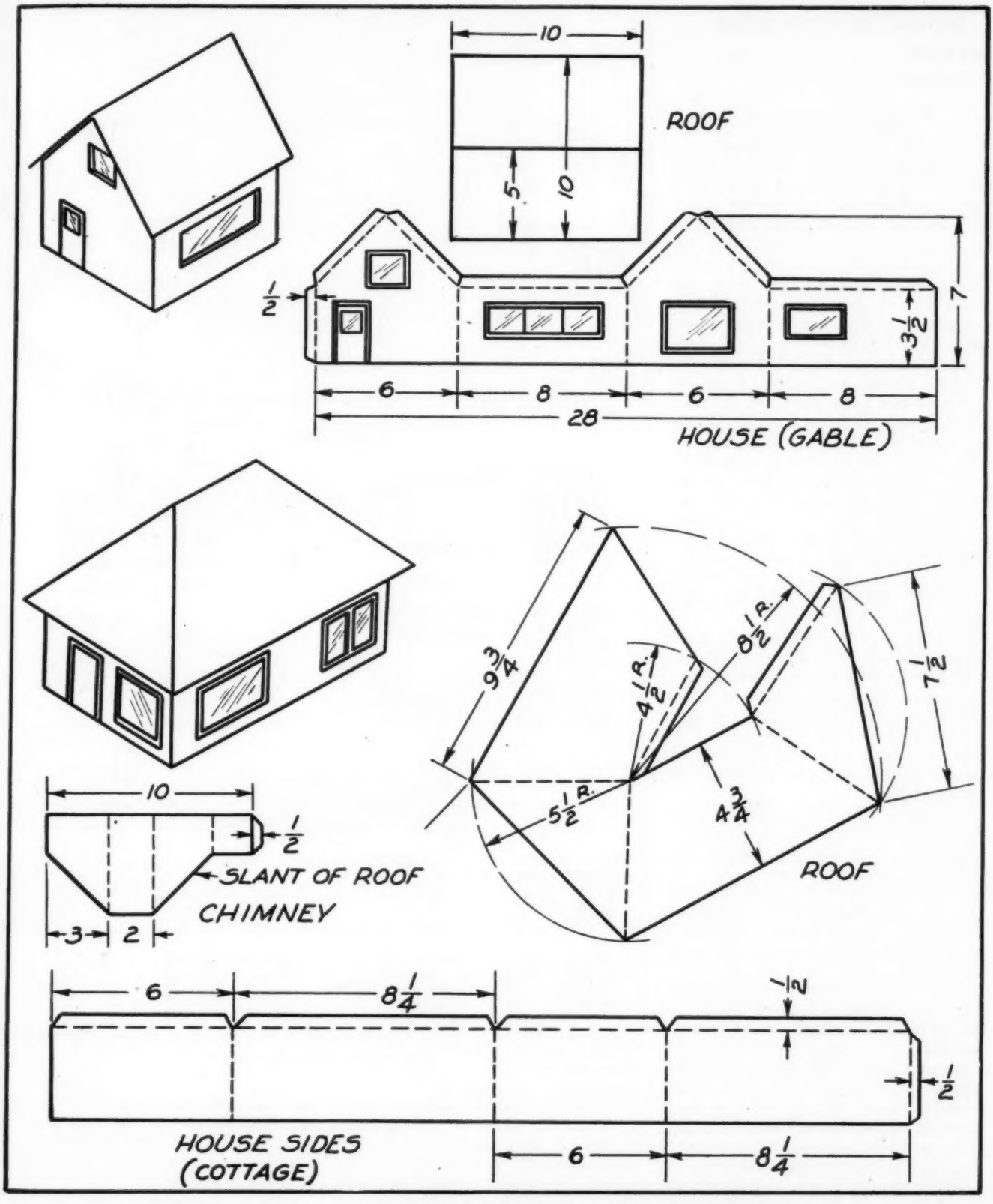
5. Select two pieces of pine stock 1 by 8 by 12 in. Make a lap joint and drill holes to fit the ¼ by 2½-in. bolts. See Figure 2.

6. Make the pedestal from four pieces of pine stock 1 by 6 by 18 in., as shown in Figure 2. Nail the platform to the top of this stand.

7. The base is made from two pieces of 2 by 8 by 24-in. fir. Make a lap joint and fasten the two pieces together with four No. 8 by 1¾-in. f.h. screws. Nail this base to the bottom of the pedestal.

8. When the concrete has cured, pick up the wheel and place it on the pedestal so that the bolts go into the holes provided for them. Fasten the top in place with washer and nuts.

9. Any deformities that still exist in the cement between the pieces of vitrilite may now be pointed up with clear cement and water, and any finish that is desired may be applied to the stand and the edge of the wheel.



Building layouts by George A. Willoughby, Michigan State Normal College, Ypsilanti, Mich.

— Drawing by Norman W. Risk, Michigan State Normal College, Ypsilanti, Mich.

INDIAN SILVERSMITHING

BEN HUNT
Hales Corners, Wis.

Silver Hatbands

Through the Southwest one occasionally sees an Indian whose ten gallon hat is decorated with a silver hatband instead of the usual ribbon or beaded band. Probably the tourist may think one of those bands would be a nice thing to put on his own hat to show the folks back home. He will be surprised to discover that there are none to be had at the trading posts. In fact, the writer has never seen one on display anywhere except on an Indian's hat. Perhaps the tourist may think that he can persuade the Indian to sell the one he is wearing, but the chances are the Indian will give him a stony stare and walk on. Also, when the Indian hocks his hat, he will remove the band first.

To make one or both of the hatbands shown in the illustration, some thin silver will be required. Having only some 24-ga. silver on hand, the writer used that, but 26-ga. would probably have been a little better. On the other hand 28-ga. silver would be too thin and will not take stamping so well. Thinner metal could, however, be ornamented with jiggle engraving.

These hatbands are usually from ⅜ to ½ in. wide, and because of their length (a No. 7 size band is about 23½ in. long), they are best made in sections, linked together. The number of sections is arbitrary. The more sections, the more work is involved, but the band will fit better because the slight taper of the crown will be taken up at the greater number of links.

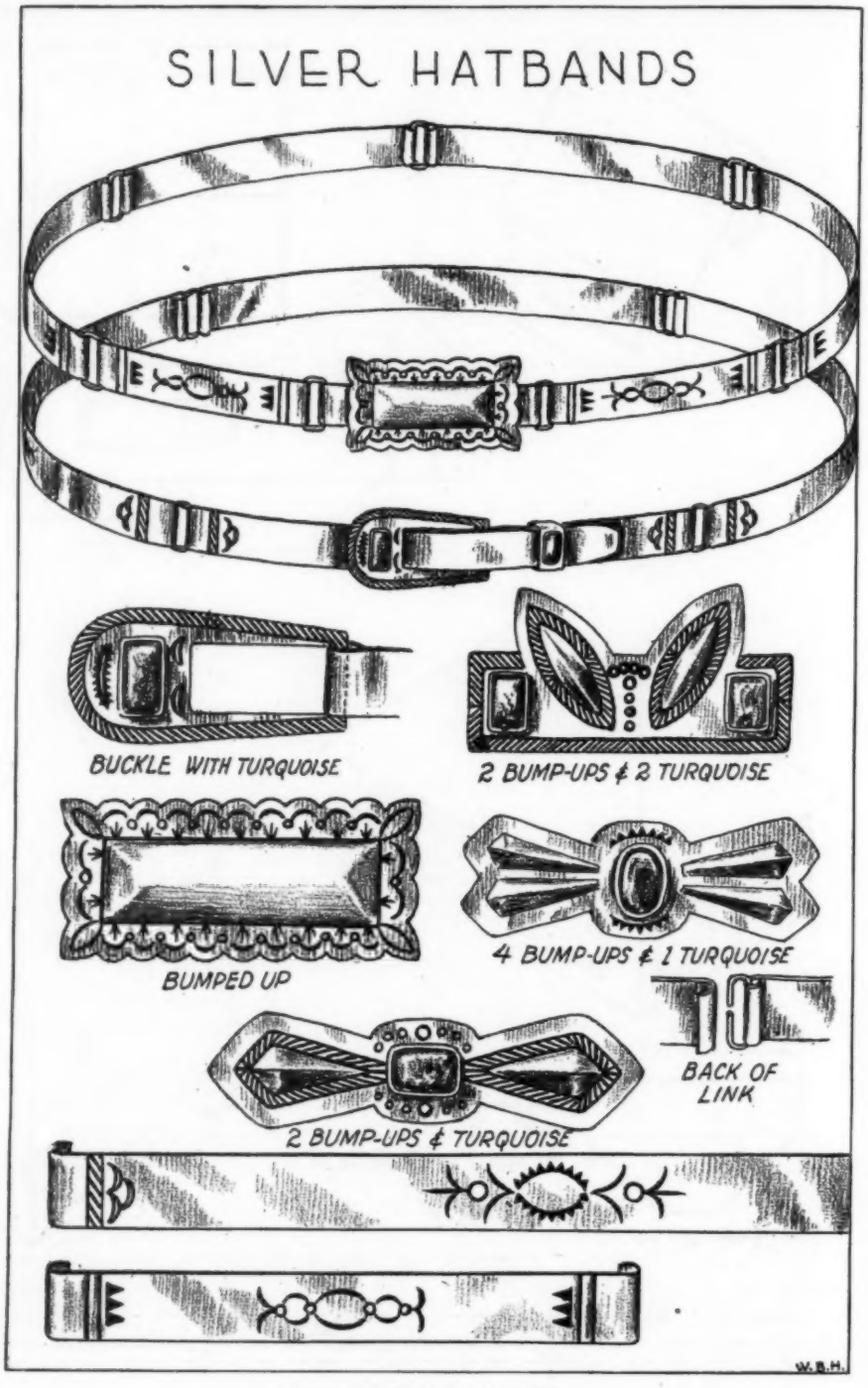
It is best to remove the old ribbon so that the silver band will lay flat on the crown. There need be no fear that the hat will stretch with a metal band on it.

On a stiff hat the *bottom of the bow* will have to be just about even with the bottom of the band, while on an old or soft hat it can fit like the one shown on the old hat in the half tone.

Decide on how many sections you wish to have. Then measure the circumference of the hat and divide it equally. Quarters seem to look best.

One of the bands, with the buckle, is adjustable as can be seen in the drawing. The keeper is pinched tight to hold it to some extent but the band is sewed tight onto the hat crown to prevent loosening. In fact, all metal hatbands must be sewed onto the crown.

Unless you wish to use turquoise settings the entire hatband can be made without any soldering, providing the *loops* on either side of the *bow* are left on. Otherwise they will, of course, have to be soldered on. There is no need of soldering the end loops, as there is not enough strain on them to warrant it, and they do not show, being on the inside.



Silver hatbands by Ben Hunt

It is suggested that the stamping be not overdone. Just enough to give it that Indian look. For finishing it is more appropriate to give the band a dull rather than a high polish. The new hat in the photograph is a stiff Stetson which would not take a *bow* going below the band, such as is shown in the old hat. Since the old hat had quite a bit of taper, the band was made in seven sections while the new and better hat took the four section band perfectly.

There are many ways to make these bands. Some are made as wide as an inch, but these would look good only when worn on the very high crowned hats.

How Ben Hunt's hatbands look on the hats

LATHE CENTERS

J. H. McCLOSKEY
Head of Technical Department
High School
Lakewood, Ohio

It is quite a problem to keep lathe centers in good condition especially with a class of beginners. A few years ago we tried tungsten steel points for the dead centers and most of our lathe-center troubles have vanished. The centers just cannot be heated so they become unsatisfactory so I cannot see how the new carbide tipped lathe center could be any more satisfactory.

For a No. 3 center we use a 5/16-in. and for a No. 2 a 1/4-in. point. For the 5/16-in. points a bar of high speed steel is purchased at about $1.35 a pound. Temper a cold chisel to a reddish brown and with it nick the bar 1 1/8 in. from the end. Put the bar in the vise with the nick even with the end of the vise jaw and knock off the point by hitting on the side opposite the nick. The points are then chamfered about 1/32 on each end as shown at *C* and later hardened. The high speed steel rods are .004 to .008 in. larger than 5/16 in. and frequently are not perfectly round.

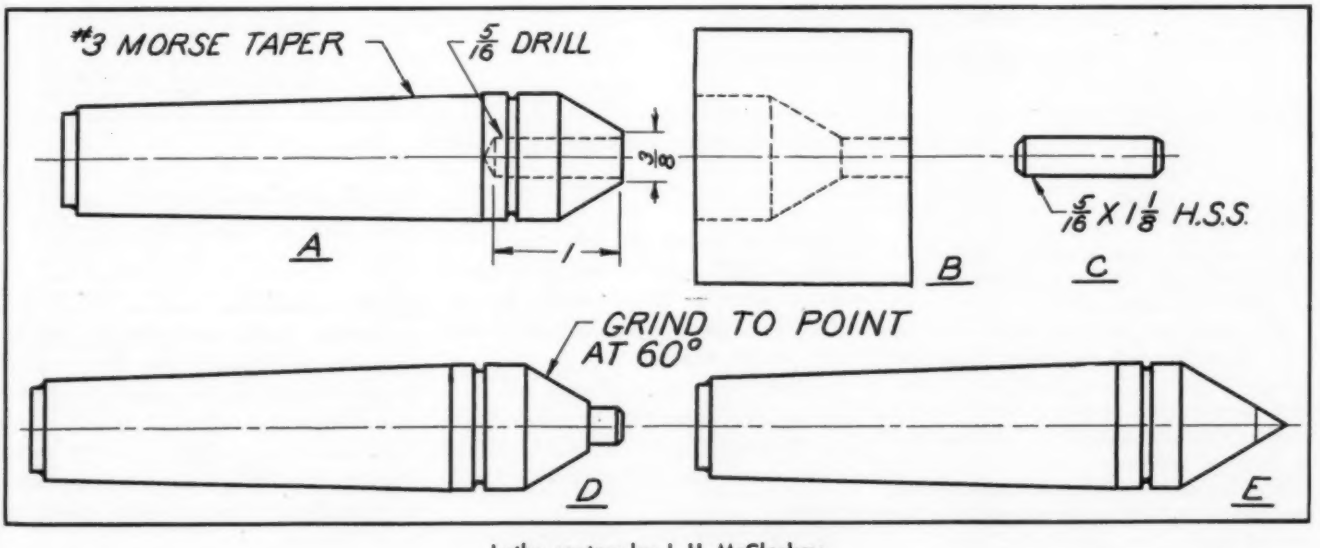
The lathe center as shown at *A* is made of soft steel with the taper accurately ground. The end that is to be pointed at 60 deg. should be left about 3/8 in. in diameter. A 5/16 hole is then drilled about 1 in. deep, so that the point, when it is pressed in, will protrude almost 5/16 which is about right. The jig shown at *B* is helpful to get the point *C* started straight. The 5/16 hole in the soft steel center is just right for most of the points. However it is well to *mike* each point and lay aside those that are much out of round and enlarge the hole with an *O* drill before pressing them in.

The point being several thousandths larger than the hole, considerable pressure is required to force it into place. An arbor press is the best tool to use in doing this job, although a big vise is satisfactory for doing the job. The point also may be driven in with a heavy hammer but this should not be attempted without holding brass on the end of the hardened steel piece. After the point is forced into place, as shown at *D*, it can be rough ground by hand and then finished with the center grinder. We have been forcing these high speed points into the soft steel centers for several years and have never had one come out or get loose.

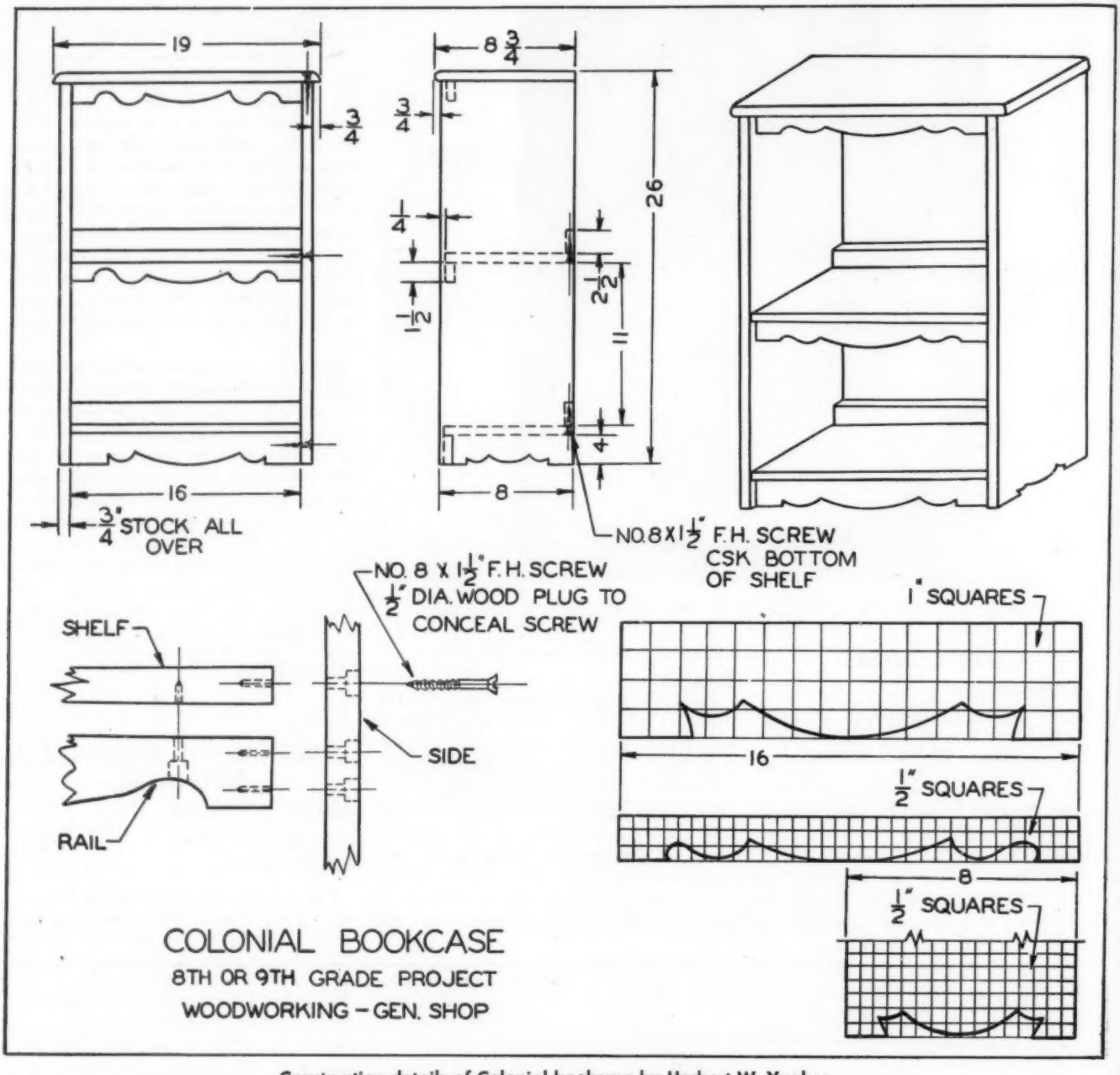
DESIGN FOR COLONIAL BOOKCASE

HERBERT W. YANKEE
Stratford High School
Stratford, Conn.

The Colonial bookcase lends its charm to many room settings. It can be used as a



Lathe centers by J. H. McCloskey



Construction details of Colonial bookcase by Herbert W. Yankee

nightstand in a bedroom or as a book or album case in a living room or den. The shelves were planned to accept a full set of encyclopedia size books or a random selection of books and a small radio.

The project has been successfully made by over 300 eighth- and ninth-grade pupils and involves the use of many hand tools. Several kinds of wood have been used with the most popular being pine and maple. The treatment of finish is optional.

The use of butt joints and wood screws provide rigidity and solid construction. The project has a great appeal for boys.

* * *

Speed took 13,300 lives last year. Speed caused 475,500 injuries last year. Speed was the dreadful mistake made by *one out of every three* drivers involved in last year's serious accidents.

In their 1951 booklet of street and highway accident data, The Travelers Insurance Companies record a total of 35,500 fatalities last year compared with 31,800 in 1949.

In 1950, there were 3700 more persons killed than in 1949 and there were 235,800 more persons injured last year than in 1949.

The comparative study of U. S. war and traffic deaths conducted by the Association of Casualty and Surety Companies, reveals that the aggregate of lives lost in highway accidents since 1900 is now approximately 1,012,000, some 7000 higher than the total of American military fatalities in all of the nation's wars during the past 177 years.

Teaching Materials For Industrial Education

CHRIS H. GRONEMAN
Head, Industrial Education Department
School of Engineering
The Agricultural and Mechanical College of Texas
College Station, Tex.

(Continued from page 38A of the April, 1952, issue)

Illuminating Engineering Society
1860 Broadway
New York 23, N. Y.

Because of errors that crept into this listing, kindly delete all of the material under the above title on page 125 in the April, 1952, issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION.

Instead of that list make use of the following:

I.E.S. Approved Lighting Practices:
- Home Lighting Recommended Practice (1947)
- Office Lighting Recommended Practice (1947)
- Street and Highway Lighting American Standard Practice (1947)
- Lighting Practices for Stores and Other Merchandising Areas (1948)
- School Lighting American Standard Practice (1948)
- Library Lighting Recommended Practice (1950)
- Daylighting Recommended Practice (1950)
- (Booklets above available at 50 cents per copy or in quantity as follows: first 4 copies, 50¢ each; next 20, 25¢ each; all over 24 copies, 15¢ each)
- Industrial Lighting American Recommended Practice (1942): first 10 copies, 25¢ each; next 40, 20¢ each; all over 50 copies, 15¢ each

Lighting for Woolen and Worsted Textile Mills (1949), 50¢ each (quantity prices upon request)
Lighting for Machining of Small Metal Parts (1949), 50¢ each (quantity prices upon request)
Lighting for Flour Mills (1949), 50¢ each (quantity prices upon request)
Lighting for Canneries (1950), 50¢ each (quantity prices upon request)
Lighting for Bakeries (1950), 50¢ each (quantity prices upon request)
Contemporary Lighting in Modern and Traditional Interiors (1951), $1 each (quantity prices upon request)
Lighting Data Sheets:
- Series XII and XIII, 24 sheets each, $1 per series
- Series XIV and XV, 24 sheets, $1.25 series
- Series XVI, subscription for 24 sheets, $1.25

Experiments With Light, 25¢ each
Lighting Fundamentals, $1 each, 10 or more, 75 cents
Lighting Design Problems Course, $1.50 each; 10 or more, $1.25
Testing Procedures for Illumination Characteristics (1948), $1 each
Standard Method for Measuring and Reporting Illumination from Artificial Sources in Building Interiors, 10¢ each
Footcandle Survey for Artificial Illumination in Interiors (for use with preceding item), 2¢ each
Lighting Equipment Engineering Data Sheet, 10¢ each
Art Gallery Lighting (1945): First 4 copies, 50¢ each; next 20, 25¢ each; all over 24 copies, 15¢ each
Lighting Principles and Practice, 50¢
Guide for Lighting Data Sheets and Lighting Problems, 50¢
Illuminating Engineering; subscription price, $10 per year, plus 50¢ for delivery abroad; single copies, $1.50 each

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Forest Products Laboratory
Madison 5, Wis. (Continued)

Comparative Value of Timber Cut from Live and Dead Trees, No. 101
Comparative Strength of Air-Dried and Kiln-Dried Wood, No. 180
Coatings that Prevent End Checks, No. 186
Coatings for the Prevention of End Checks in Logs and Lumber, R1435
Copper Salts Improve Casein Glue, No. 170
Comparison of Redwood and Flat-Grained Yellow-Poplar for Cores in Furniture Panels, No. 1785
Casein Glues: Their Manufacture, Preparation, and Application, D280
Distinguishing Characteristics of Mahogany and Woods Commonly Called Mahogany, No. 162
Differences Between Heartwood and Sapwood, No. 189
Dormant Buds Are Not the Cause of Bird's Eyes in Maple
Dry-Kiln Building Materials and Construction, R-1646
Drying Stresses in Lumber Seasoning, R1652
Decrease Water-Increase Profits, R-1633
Drying and Conditioning Glued Joints, D475
Economical and Efficient Kiln Operation, R1647
Function and Calculation of Ventilation in Drying Compartments, R1265
Fabrication of Wood Products at Small Sawmills and Woodworking Plants, R-1666-8
Foreign Woods Imported into the United States (a list)
Government Publications of General Interest on Wood and Trees, No. D-6
Glue and Plywood
Growth, Structure, and Identification of Wood
General Recommendations Regarding Methods for Waste Utilization, R1666
How to Distinguish Black Ash from Commercial White Ash Lumber, D-11
How to Distinguish Mahogany and Walnut from Sweetgum, No. 103
How to Tell Birch, Beech, and Maple Apart, No. 116
How Growth Affects Quality in Hickory and Ash
How Wood Dries, R1642
Identification of Oak Woods, No. 125
Important Factors in Gluing with Animal Glue, R869
Kiln Tune-Ups to Correct Nonuniform Kiln-Drying Conditions, R1644
Kiln Drying of White Birch Turning Squares, R1702
Light Weight Ash Should be Separated in Shipping, R1153
Longitudinal Shrinkage of Wood, No. 234
Logging, Manufacture, and Utilization of Timber, Lumber, and Other Wood Products
List of Dry Kiln Companies and Engineers and Consultants in the U. S.
Moisture Content of Wood at Different Humidities, No. F-13
Methods of Controlling Humidity in Woodworking Plants, R1612
Methods of Determining the Moisture Content of Wood, R1649
Moisture Content of Wood in Use, R1655
Method for Controlling the Moisture Content of Wood Going into Furniture Production, R1685
Manufacture of Veneer
Need for Uniformity of Temperature in a Dry Kiln, R1669
Notes on the Manufacture of Flat Plywood, R543
Overheating Reduces Strength of Animal Glues, No. 104
Occurrence and Removal of Glue Stains, No. 146
Partial List of Publications for Furniture Manufacturers, Woodworkers, and Teachers of Wood Shop Practice, December 1950, No. R1775
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Smoking or Use of Tobacco in any Form, Strictly Prohibited, 5¢
Spitting is Prohibited in this Establishment, 5¢

Metropolitan Life Insurance Company
School Health Bureau
Health and Welfare Division
1 Madison Avenue
New York 10, N. Y.
Light and Shade

National Association of Manufacturers
14 West 49th Street
New York 20, N. Y.
Bulletin Board Posters, 17" x 21".
Eight Titles as Follows:
One Nation Indivisible
Oh, The World Owes Me a Living
Want a Job?
What Kind of Triangle is This?
Will You Choose a Job This Way?
You Sure Can Go Places in America
What You Do Now Pays Off
Vote Now — Vote Later

National Board of Fire Underwriters
85 John Street, New York 38, N. Y.
222 West Adams Street, Chicago 6, Ill.
1014 Merchants Exchange, San Francisco 4, Calif.
Protect Your Home and Family — Prevent Fires
Fire Drills May Save Your Life
Put It Out Before It Puts You Out
313,000 Fires Started Here

National Child Labor Committee
419 Fourth Avenue
New York 16, N. Y.
Wall Chart, 3' x 4' illustrating changes in number of young workers by age groups (Loaned for Return Postage)
Exhibit Book, HAVE YOU SEEN THESE CHILDREN? (Loaned for Return Postage)
Panel Exhibit — three separate panels (each 39" wide, 48" high) (Loaned for shipping costs each way)

Pequot Mills
Empire State Building
New York 1, N. Y.
Pequot Educational Exhibit, a series of six mounted cards, 11" x 14", 50¢ per unit
Pequot Bedmak-Chart

Proctor & Gamble Company
Cincinnati 1, Ohio
Ivory Inspection Patrol

Sears, Roebuck and Company
Consumer Education Division
925 South Homan Avenue
Chicago, Ill.
Exhibits for loan, free except for return postage
Fabric Exhibit
Better Care of Textiles
Closet Accessories
Paint and Wallpaper
Freezer Exhibit
Table Service
Window Treatment
Slip Cover and Upholstery Exhibit
Floor Covering Exhibit

Texas Gulf Sulphur Company
911 Second National Bank Building
Houston 2, Tex.
Sulphur Source, Texas and Louisiana
Sulphur Mining at Newgulf

United States Department of Labor
Bureau of Labor Standards
Washington 25, D. C.
America Needs All of Us
Don't Forget, Ability Counts
Handle Carefully and Keep Oil Off Floors
Learn to Lift Correctly
Right and Wrong Way to Lift
Sight Security
Yank Them Out and See Over Your Load
Home From a Safe Workday
Industrial Injury Exhibit
Occupational Outlook
What Makes an Industrial Safety Program

Wheat Flour Institute
309 West Jackson Blvd.
Chicago 6, Ill.
We Work Together
A Modern Health Experiment
Design for Better Living
From Wheat to Flour
A Kernel of Wheat

United World Films, Inc.
1445 Park Avenue
New York 29, N. Y.
The Earth and Its Peoples

METALS

Aluminum Company of America
Education Service Section
818 Gulf Building
Pittsburgh 19, Pa.
8-Art Cards
Chart on Chemistry and History of Aluminum

American Iron and Steel Institute
350 Fifth Avenue
New York 1, N. Y.
Major Steps in Steelmaking
Steel — From Mine to You

American Products Corporation
422 South Dearborn Street
Chicago 5, Ill.
Silver Solder Torch and Kit, 10¢

American Welding Society
33 West 39th Street
New York 18, N. Y.
Symbols Wall Chart, A2.1–47, 50¢
Master Chart for Welding Processes and Process Charts, A3.1–49, 50¢

Anaconda Copper Mining Company
Advertising Department
25 Broadway
New York 4, N. Y.
Flow Sheet of Copper Smelting (Sulphide Minerals)
Copper is the Trunk of an Indispensable Family Tree

Atlas Press Company
Kalamazoo, Mich.
Lathe Cutting Tools
The Modern Back-Geared Screw-Cutting Lathe
Thread Forms and Formulas
60° V-Type Thread Dimensions
Decimal Equivalents
At Your Finger Tips

Brown & Sharpe Mfg. Company
Providence 1, R. I.
Vernier Tools
Decimal Equivalents
Universal Bevel Protractor Readings
Vernier Readings
Micrometer Readings
Micrometer Caliper Sectional View
The New Brown & Sharpe Micrometer
Brown & Sharpe Tools Chart

Cincinnati Milling and Grinding Machines, Inc.
Cincinnati 9, Ohio
No. 2 ML and 2 MI Milling Machines
Dial Type Milling Machine
0–8 Vertical Milling Machine
No. 2 Cutter and Tool Grinder
No. 2 Centerless Grinder
12" Hydraulic Universal Grinder

Cincinnati Shaper Company, The
Hopple, Garrard and Elam Streets
Cincinnati 25, Ohio
20 Shaper Cross Section Charts

Columbian Vise & Mfg. Company, The
9021 Bessemer Avenue
Cleveland 4, Ohio
For Proper Vise Care

Henry Disston & Sons, Inc.
Tacony
Philadelphia 35, Pa.
Educational Charts:
Choosing and Using Disston Files, No. 4
Disston Hack Saw Chart, No. 3

General Motors
Educational Service
Department of Public Relations
Detroit 2, Mich.
From Iron Ore to Finished Product

Globe Steel Tubes Company
Milwaukee 46, Wis.
Corrosion and Heat Resisting Steel Analysis Chart
Table of Bursting Pressures of Seamless Steel Tubing

Kearney & Trecker Corporation
Milwaukee 14, Wis.
Studyview of Universal Style Milling Machine

LeBlond Machine Tool Company, R. K.
2694 Madison Road
Cincinnati 8, Ohio
Wall Charts on Machines

Lufkin Rule Company, The
Saginaw, Mich.
Decimal Equivalents of Fractions of an Inch
Decimal Wall Chart
Micrometer Chart
Time Saver and Drill Card

Remington Arms Company, Inc.
Bridgeport, Conn.
Outdoor Small-Bore Rifle Range — 10 Target Unit
What's Your Score on Safe Gun Handling
Pistol Range Construction-A-Plan of Range, 20 Targets
Suggested Indoor Pistol Range

Revere Copper and Brass Incorporated
230 Park Avenue
New York 17, N. Y.
Paul Revere's Ride

South Bend Lathe Works
425 East Madison Street
South Bend 22, Ind.
Tap Drill Sizes, Drawing No. C-199
Decimal Equivalents, Drawing No. 777
How to Become a Machinist, Drawing No. 250
South Bend Lathe, Drawing No. 890

Starrett Company, The, L. S.
Athol, Mass.
Decimal Chart
Tool Chart
Tap and Drill Chart
Micrometer Chart
Set of Educational Charts
Set of Student Note Book Charts, 15¢ set

Turner Brass Works
Sycamore, Ill.
Turner Tested Torches

United States Department of Labor
Bureau of Labor Standards
Washington 25, D. C.
Drill Presses — Series A, 5¢
Grinding Wheels — Series F, 5¢
Screwdrivers — Series L, 5¢
Hammers — Series P, 5¢
Engine Lathes — Series D, 5¢
Metal Shapers — Series G, 5¢
Wrenches — Series I, 5¢
Use Arc Welding Equipment Safely — Series J, 5¢
Gas Welding and Cutting Equipment — Series M, 5¢
Safe Operation of Power Shears — Series S, 5¢
Use Cold Chisels Safely — Series U, 5¢

Walker-Turner Division
Kearney & Trecker Corporation
Plainfield, N. J.
Students Plan Sheet
Use of the Drill Press

Wilson Products, Inc.
Reading, Pa.
Wear Your Safety Goggles

PLASTICS

Formica Company, The
4614 Spring Grove Avenue
Cincinnati 32, Ohio
Formica Samples

Hercules Powder Company
Wilmington, Del.
Students' Safety Instructions in Chemical Laboratories

Monsanto Chemical Company
Plastics Division
P.O. Box 1531
Springfield 2, Mass.
Plastic Samples

Rohm & Haas Company
Washington Square
Philadelphia 5, Pa.
Plastic Samples

TRANSPORTATION

Association of American Railroads
School and College Service
Transportation Building
Washington 6, D. C.
- Teacher's Kit for a Study of Railroad Transportation, includes:
  - Fifty-six Railroad Pictures
  - The Stories Behind the Pictures
  - Teachers Manual
- Set of Seven Charts
  - Railroads and National Defense
  - Going Places by Rail
  - Railroads and the Community
  - Railroads and Industry
  - Railroads and World Trade
  - How Railroads Serve
  - Railroads and American Life

Bendix Products Division
Bendix Aviation Corporation
South Bend 20, Ind.
- Colored Wall Chart (Cross Sectional) No. 10-513
- Colored Wall Chart (Cross Sectional) No. 10-514
- Trouble Shooting, Check Sheet, No. 10-405

Bicycle Institute of America, Inc.
122 East 42nd Street
New York 17, N. Y.
- Suggested Designs for Bicycle Racks of Wood
- Bike Safety Aids
- Be Sure Your Bike is Ready to Go
- Use Your Bike Hand Signals
- Bicyclist's Signals
- Bicyclist's Safety Rules

Buick Motor Division
Flint 2, Mich.
- Buick's 47 Years of Progress

Case Company, J. I.
Racine, Wis.
- Sawdust Sam Learns the Hard Way — Do You?
- Case "D" Series Engine

Edison, Incorporated, Thomas A.
Edison Storage Battery Division
West Orange, N. J.
- Edison Nickel-Iron-Alkaline Storage Cell

Electric Storage Battery Company
Philadelphia, Pa.
- Parts and Assembly of a Portable Storage Battery

Employers Mutuals of Wausau
Safety Engineering Department
Wausau, Wis.
- Be a Better Biker
- They Don't Have to Die!
- Little Child Injured First Day of School
- Somebody's Boy

General Motors
Educational Service
Department of Public Relations
Detroit 2, Mich.
- Engine Types
- Cylinders and Paddle Wheels
- Engine Efficiency
- Diesel Cycle Diagram
- Four-Stroke Cycle and Flame Travel
- Rear Axle
- Fuel System
- Chassis
- Ignition System
- Brake System
- Steering System
- Three-Speed Gear Transmission
- Body Construction
- Automobile Stopping Distances
- Automobile Progress
- 9,000,000 Jobs

International Harvester Company
180 North Michigan Avenue
Chicago 1, Ill.
- Four-Stroke Engine Cycle, No. A-170-FF
- Farmall Cub Sectional View, No. A-261-KK
- IH Purolator Oil Filter Element, No. A-258-NN
- TD-24 Crawler Tractor Cutaway, No. A-664-NN
- Silver Diamond Engine Cutaway, No. A-51-NN
- No. 64 Harvester Thresher Sectional View, No. CR-358-A

New York Central System
Public Relations Department
466 Lexington Avenue
New York 17, N. Y.
- How Railroads Serve, No. 1
- Railroads and World Trade, No. 2
- Railroads and Industry, No. 3
- Railroads and the Community, No. 4
- Going Places by Rail, No. 5
- Railroads and American Life, No. 6

New York University
Center for Safety Education
New York, N. Y.
- The War on Occupational Accidents
- Home Accidents
- The War on Traffic Accidents

Westinghouse Electric Corporation
306 Fourth Avenue
P.O. Box 1017
Pittsburgh 30, Pa.
- J-34 Turbojet Engine Wall Chart

Wilson Products, Inc.
Reading, Pa.
- Wear Your Safety Goggles

WOODS

American Walnut Manufacturers Association
666 North Lake Shore Drive
Chicago 11, Ill.
- American Walnut
- Let Young Walnut Trees Grow
- Let Young Cedar Trees Grow

Atkins and Company, E. C.
402 South Illinois Street
Indianapolis 9, Ind.
- Wall Chart
- Atkins Silver Steel Practice Filing Strips
- Shop Management Chart

Central Felt Company
Department P. C.
24-26 West 25th Street
New York 10, N. Y.
- Swatched Color Card and Price List, 25¢

Columbian Vise and Mfg. Company, The
9021 Bessemer Avenue
Cleveland 4, Ohio
- For Proper Vise Care

Disston and Sons, Inc., Henry
Tacony
Philadelphia 35, Pa.
- Educational Charts:
  - How to Use a Disston Hand Saw, No. 1
  - How A Disston Hand Saw Cuts, No. 2
  - Choosing and Using Disston Files, No. 4
  - Disston Wood Turning Chisels, No. 5
  - Disston Special Purpose Saws, No. 6

Douglas Fir Plywood Corporation
301 Tacoma Building, Tacoma 2, Wash.
848 Daily News Building, Chicago 6, Ill.
1232 Shoreham Building, Washington 5, D. C.

The 500 Fifth Avenue Building, New York 18, N. Y.
- Wall Chart of Douglas Fir Plywood Grades and Uses

Forest Industries Information Committee of Minnesota
516 Lyceum Building
Duluth 2, Minn.
- Estimated Value of Forest Products Harvested in Minnesota in 1949

Franklin Glue Company, The
131 West Chestnut Street
Columbus 15, Ohio
- Liquid Hide Glue

Greenlee Tool Company
Rockford, Ill.
- Improved Hand Calculator for Woodworkers, 25¢
- Wall Chart

Homosote Company
P.O. Box 441
Trenton, N. J.
- Samples of Homosote Products

LePage's Incorporated
Gloucester, Mass.
- Do's and Don'ts for Gluing

Lufkin Rule Company, The
Saginaw, Mich.
- Decimal Equivalents of Fractions of an Inch

McKnight and McKnight Publishing Company

Market and Center Streets
Bloomington, Ill.
- Wood Finishing Wall Charts

National Lumber Manufacturers Association
1319 Eighteenth Street, N.W.
Washington 6, D. C.
- Our Abundant Forests

North Brothers Mfg. Company
Philadelphia 33, Pa.
- "Yankee" Screw Chart

Southern Pulpwood Conservation Association
1506 First National Bank Building
Atlanta 3, Ga.
- I Grow Trees

Stanley Tools
New Britain, Conn.
- Instruction Charts, $5.50 set
- Stanley Safety Charts, $2.50 set
- Six Woodworking Patterns, 25¢ complete
- Packet, Series A — 15 Early American Designs, 25¢
- Packet, Series B — 15 Early American Designs, 25¢
- 95 Plans in Loose Leaf Binder (same 95 plans included in sets listed below), $2
- Sets of Plans at 10¢ per set (5 plans per set)
  - Set No. 1 — Hanging Shelves
  - Set No. 2 — Table Lamps
  - Set No. 3 — Trays
  - Set No. 4 — Small Tables
  - Set No. 5 — Gift Projects
  - Set No. 6 — Gift Projects
  - Set No. 7 — Mirrors, etc.
  - Set No. 8 — Smoking and Magazine Stands
  - Set No. 9 — Boxes and Chests
  - Set No. 10 — Tables and Stands
  - Set No. 11 — Workshop Equipment, Lawn Chair
  - Set No. 12 — Sewing Stand, etc.
  - Set No. 13 — Coffee Table, Bookshelf, etc.
  - Set No. 14 — Bird Houses, Garden Furniture
  - Set No. 15 — Small Colonial Furniture
  - Set No. 16 — Children's Toys
  - Set No. 17 — Folding Tables and Trays
  - Set No. 18 — Card Table, Nests of Tables
  - Set No. 19 — Bedside Chest, Child's Rocker, etc.
- "Yankee" Screw Driver Chart
- Russell Jennings Auger Bit Folder

United States Department of Agriculture
Forest Service
Washington 25, D. C.
- How a Tree Grows (16" x 21"), No. W-3
- Smokey Bear — Forest Fire Prevention (18" x 26"), No. W-7
- Set of Six Farm Forestry Posters, Each 14" x 20", No. W-10
- Effects of Windbreaks on Wind Velocity (black and white, 8" x 10½", No. D-2
- How Fire Ruins Timber (black and white, 8" x 10½")
- What We Get From Trees (four colors, 28" x 40"), Shows in graphic form the tree and its many products, No. D-5
- Forest Trees and Forest Regions of U. S. (18" x 24"), No. V-1

United States Department of Labor
Bureau of Labor Standards
Washington 25, D. C.
- Drill Presses — Series A, 5¢
- Grinding Wheels — Series F, 5¢
- Screwdrivers — Series L, 5¢
- Hammers — Series P, 5¢
- Circular Saws — Series B, 5¢
- Woodcutting Band Saws — Series E, 5¢

Walker-Turner Division
Kearney and Trecker Corporation
Plainfield, N. J.
- Students Plan Sheet
- Use of the Drill Press
- Use of the Grinder
- Use of the Band Saw
- Wood Lathe

West Coast Lumberman's Association
1410 S. W. Morrison Street
Portland 5, Ore.
- The Lumber Contents of a Douglas Fir Log
- Where We Grow Our Trees
- Products of American Forests

Western Pine Association
Yeon Building
Portland 4, Ore.
- Sheet 1, Standard Patterns (19½" x 23½"), Dropping sid, rustic, shiplap, flooring, etc., No. O-1, 30¢
- Sheet 2, Standard Patterns (26" x 23½"), Siding, roofing, cribbing, ceiling, jamb, sill, No. O-2, 30¢
- Sheet 3, Standard Patterns (16" x 23½"), Log cabin siding, casket stock, shelving, No. O-3, 25¢
- Sheet 4, Standard Patterns (19" x 19"), Thick flooring and decking, No. O-4, 20¢
- Full Set of Sheets 1, 2, 3, and 4, All standard patterns as listed above, No. O-5, $1 set
- Western Pine Paneling Patterns, Associated Standard, (16½" x 21"), Profile drawings of paneling patterns shown in G-20, No. O-7, 25¢
- How to Make an Inlaid-Initialed Bracelet, No. 1
- How to Make "LADDIE," a Scottie Doorstop or Garden Stick, No. 2
- How to Make a Unique Cigarette Box, No. 3
- How to Make a Pipe Rack with Western Pines, No. 4
- How to Make a Knotty Pine Coffee Table, No. 5
- "Evolution of a Scottie" — A sawn and carved project, No. 6
- Pine Pinto Hobby Horse Swing, No. 7
- A Bird Feeding Station, No. 8
- A Koa Hospitality Tray — Scroll Sawing and Carving, No. 9
- How to Make a Knotty Pine Bookcase, No. 10
- How to Make a Knotty Pine Chest, No. 11
- A Sturdy Scooter for Youngsters, No. 12
- Colonial Bookcase and Cabinet, No. 13
- A Modernistic Corner Table, No. 14
- Child's Hobby Horse Desk, No. 15
- Wading Tank for Youngsters, No. 16
- How to Make a Bicycle Rack of Western Pines, No. 17
- A Collapsible Barbecue Table, No. 18
- Table and Chairs for Tiny Tots, No. 19
- A Sportsman's Rod and Gun Cabinet, No. 20
- Open Front Colonial Bookshelf, No. 21
- How to Make a Pair of Western Pine Clogs, No. 22
- Plan Book for the Boy Builder (5¾" x 7¾"), No. 24
- Wood Carving for Pleasure (5¾" x 7¾"), No. 35
- Wood Turning in the Home Workshop (5¾" x 7¾"), No. 36

Wilson Products, Inc.
Reading, Pa.
- Wear Your Safety Goggles

Yates-American Machine Company
Beloit, Wis.
- Models for Wood Working Shop Layouts, may be purchased on 60 day loan basis or an outright purchase of $1 a model

FILMS

DRAWING

University of Kansas
Bureau of Visual Instruction
University Extension
Lawrence, Kans.

All 16mm. sound motion — sf means Service Fee
Drafting Tips, Service Fee $2.50
Draftsman, sf $1.25
Draftsmen of Dreams, sf $2.50
Drawing for Beginners — The Circle, sf $1.25
Drawing for Beginners — The Rectangle, sf $1.25
Drawing for Beginners — The Square, sf $1.25
Drawing for Beginners — The Triangle, sf $1.25
Drawing with a Pencil, sf $1.25
Engineering Drawing, Auxiliary Views — Single Auxiliaries, sf $2.50
Engineering Drawing, Auxiliary Views — Double Auxiliaries, sf $1.25
Engineering Drawing, Drawings and the Shop, sf $2.50
Engineering Drawing, Introduction to Engineering Drawing, sf $1.25
Engineering Drawing, Orthographic Projection, sf $2.50
Engineering Drawing, Sections and Conventions, sf $2.50
Engineering Drawing, Selection of Dimensions, sf $2.50
Fractions — How to Add, sf $1.25
Fractions — Decimal, sf $1.25
Fractions — How to Change, sf $1.25
Fractions — How to Divide, sf $1.25
Fractions — How to Multiply, sf $1.25
Fractions — How to Subtract, sf $1.25
Fractions — Percentage, sf $1.25
Fractions — What Are, sf $1.25
Mechanical Drawing — Auxiliary Views Part I, sf $1.25
Mechanical Drawing — Auxiliary Views Part II, sf $1.25
Mechanical Drawing — Language of Drawing, sf $1.25
Mechanical Drawing — Sections, sf $1.25
Mechanical Drawing — Shape Description, Part I, sf $1.25
Mechanical Drawing — Shape Description, Part II, sf $1.25
Mechanical Drawing — Shop Procedure, sf $2.50
Mechanical Drawing — Size Description, sf $2.50

ELECTRICAL AND COMMUNICATIONS

Bausch & Lomb Optical Company
Rochester 2, N. Y.

Balopticon Slide Lectures (3¼" x 4" Slides). These slide lectures are available on a loan basis without charge. Specify date wanted. Booklet giving text and illustrations sent on request.
Look Inside Your Eyes — 39 slides
Let's Make a Pair of Glasses — 32 slides

Edison, Incorporated, Thomas A.
West Orange, N. J.

Storage Battery Power, 16mm. black and white, sound-on-film
Modern Material Handling, 16mm. black and white, soumd-on-film
Modern Battery Shop Practice, 16mm. black and white, sound-on-film

General Electric Company
Distribution Section
Advertising and Sales Promotion Division
Schenectady 5, N. Y.

(Requests should be sent to nearest General Electric Company office — obtain address from above office.)
Silicones, 16mm. sound, black & white, 10 min., No. S-2603
The Light in Your Life, 16mm. sound, color, 20 min., No. AS-2666
The Family Album, 16mm. sound, color, 30 min., No. AS-2629
Sightseeing at Home, 16mm. sound, black & white, 15 min., No. S-2487
Principles of Electricity, 16mm. sound, color, 20 min., No. S-2585
Curves of Color, 16mm. sound, color, 10 min., No. S-2451
Exploring With X-Rays, 16mm. sound, black & white, 40 min., No. S-2464
The World's Largest Workshop, 16mm. sound, black & white; 30 min., No. S-2428
Excursions in Science, No. 3, 16mm. sound, black and white, 11 min., No. S-2343
Excursions in Science, No. 4, 16mm. sound, black and white, 9 min., No. S-2344
Excursions in Science, No. 5, 16mm. sound, black and white, 9 min., No. S-2345
Excursions in Science, No. 6, 16mm. sound, black and white, 10 min., No. S-2346
Excursions in Science, No. 7, 16mm. sound, black and white, 10 min., No. S-2347
Excursions in Science, No. 8, 16mm. sound, black and white, 7 min., No. S-2348
Thunderbolt Hunters, 16mm. sound, black and white, 10 min., No. S-2349
Thomas A. Edison, 16mm. silent, black and white, 16 min., No. 41
The Panama Canal, 16mm. silent, black and white, 15 min., No. 49
Life of Thomas A. Edison, 16mm. sound, black and white, 11 min., No. S-2259
Cooking High Style, 16mm. sound, color, 20 min., No. AS-2669
The Magic of Fluorescence, 16mm. sound, color, 17 min., No. AS-2599
Ingredient "X," 16mm. sound, color, 23 min., No. AS-2634
Don't Blame the Oven, 16mm. sound, color, 23 min., No. S-2515
Assignment for Penny, 16mm. sound, color, 20 min., No. AS-2688
Naturally It's FM, 16mm. sound, color, 24 min., No. AS-2667
Meter With a Memory, 16mm. sound, black and white, 10 min., No. S-2662

General Motors Corporation
Department of Public Relations — Film Section
General Motors Building
Detroit 2, Mich.

Requests from Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming address to:
General Motors Corporation
508 San Francisco Building
405 Montgomery Street
San Francisco 4, Calif.
Requests from Greater New York City and the Communities of Long Island address to:
General Motors Corporation
Dept. of Public Relations
1775 Broadway, New York 19, N. Y.
Magic in the Air, 16mm. sound motion, 9 min.
On to Jupiter, 16mm. sound motion, 20 min.
Grandma Goes to Town, 16mm. sound motion, color, 31 min.
Frozen Freshness, 16mm. sound motion, color, 30 min.
How to Get the Most Out of Your Refrigerator, 16mm. sound motion, 25 min.

Underwriters' Laboratories, Inc.
207 East Ohio Street
Chicago 11, Ill.

Approved by the Underwriters, 16mm. sound, 27 min.
Danger Sleuths, 16mm. sound, 16 min.

United World Films Inc.
1445 Park Avenue
New York 29, N. Y.

U. S. Government Films for Television (a bulletin)

University of Kansas
Bureau of Visual Instruction
University of Extension
Lawrence, Kans.

All 16mm. sound — sf means service fee
Atomic Energy, sf $1.25
Development of Communication, sf $1.25
Electrician, sf $1.25
Flow of Electricity, sf $1.25
Story of Electricity, sf $1.25
Electromagnets, sf $1.25
Elements of Electrical Circuits, sf $1.25
Home Electrical Appliances, sf $1.25
Industrial Measurement, sf 75¢
Magnets, sf $2
Radio Broadcasting Today, sf $2.50
Radio and Television, sf $1.25
Television — Magic in the Air, sf $1.25
Television, Stepping Along with, sf 75¢

Westinghouse Electric Corporation
School Service
306 Fourth Avenue
P.O. Box 1017
Pittsburgh 30, Pa.

More Time for Living, 16mm. Kodachrome sound, 27 min.
Adventures in Research, 16mm. and 35mm. sound, black and white, 20 min.
The Banshee, 16mm. sound, black and white, 17 min.
The Dawn for Better Living, 16mm. and 35mm. sound, color, 16 min.
Radio Frequency Heating, 16mm. sound kodachrome, 40 min.
Commutation of D-C Machines, 16mm. and 35mm. sound, black and white, 24 min.
Electronics at Work, 16mm. and 35mm. sound, black and white, 20 min.
What is Electricity?, 16mm. and 35mm. sound, black and white, 20 min.
The Bundys Breeze Through, 16mm. sound, black and white, 17 min.

HANDCRAFT

Eastman Kodak Company
Rochester 4, N. Y.

Selected References on Photographic Visual Aids
Notes on Kodachrome Slide Sequences as Aids in Business and Education
A Brief Comparison of Photographic Instructional Aids
Suggestions for Effective Slidefilm Projection
Some Sources of 2" x 2" Color Slides

General Motors Corporation
Department of Public Relations — Film Section
General Motors Building
Detroit 2, Mich.

Requests from Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming address to:
General Motors Corporation
508 San Francisco Building
405 Montgomery Street
San Francisco 4, Calif.
Requests from Greater New York City and the communities of Long Island address to:
General Motors Corporation
Department of Public Relations
1775 Broadway
New York 19, N. Y.
Sand and Flame, 16mm. sound motion, 20 min.
Many Hands, 16mm. sound motion, color, 30 min.
Assignment Soap Box Derby, 16mm. sound motion, color, 22 min.

Glatfelter Company, P. H.
Spring Grove, Pa.

A Short Course in Paper Making, 16mm. sound, color, 35 min.

Hammerhill Paper Company
Advertising Department
1646 East Lake Road
Erie, Pa.

The Gift of Ts'ai Lun — Paper, 16mm. sound, portions in color, 33 min.

Huyck and Sons, F. C.
Kenwood Mills
Albany 1, N. Y.

Paper, Pacemaker of Progress, 16mm. sound, color, 26 min.

University of Kansas
Bureau of Visual Instruction
University Extension
Lawrence, Kans.

Clay — Animals, sf $1.25
Clay — Bowls, sf $1.25
Clay, Hand, and Fire, sf 75¢
Facts About Fabrics, sf $1 (color)
Hand Industries of Mexico (color) sf $2.50
Hopi Indian Arts and Crafts (color), sf $2.50
Story of Leather, sf $1
Mexican Arts and Crafts, sf $1.25
Photography, sf $1.25
Photography — Your Movie Camera and How to Use It, sf $1.25
Pottery Making, sf $1.25
Printing — Here's How We Print, sf $1.25
Puppet Making and Operating, sf $2.50
Puppetry — String Marionettes, sf $1.25

INDUSTRIAL AND GENERAL

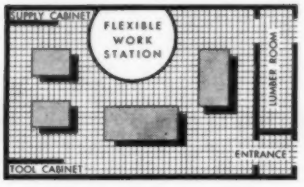
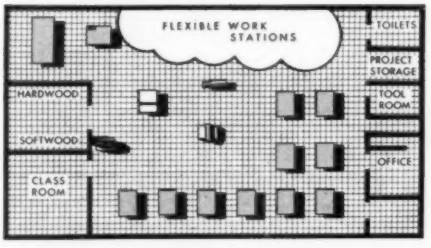
Aetna Life Affiliated Companies
Public Education Department
Hartford 15, Conn.

Don't Drop Your Guard, 16mm. sound, color, 10 min.
Asking for Trouble, 16mm. sound, black and white, 10 min.
Handle with Care, 16mm. sound, color, 15 min.
No Time to Lose, 16mm. sound, black and white, 5 min.
Check and Double Check, 16mm. sound, color, 17 min.
Doubtful Dollars, 16mm. sound, color, 17 min.
Aim for Safety, 16mm. sound, color, 17 min.
Safety Ahoy, 16mm. sound, color, 15 min.
Hook, Line, and — Safety, 16mm. sound, color, 17 min.
Partners in Production, 16mm. sound, color, 17 min.
Friend or Foe, 16mm. sound, color, 17 min.
Back to Life, 16mm. sound, color, 6 min.
Ladders, Scaffolds and Floor Openings, 16mm. sound, color, 9 min.
Lifelines, 16mm. color, sound, 10 min.
Ski Tips, 16mm. sound, color, 22 min.
Doorway to Death, 16mm. sound, color, 13 min.
Before the Blast, 16mm. sound, color, 10 min.
Fatal Seconds, 16mm. sound, black and white, 10 min.

Allis-Chalmers Mfg. Company
Advertising and Industrial
Press Department
Milwaukee 1, Wis.

Induction Heat, Industry's Modern Tool, 16mm. sound, color
Magic of Steam — Part I, 16mm. sound, black and white, 18 min.
Magic of Steam — Part 2, 16mm. sound, black and white, 18 min.
Tornado In a Box, 16mm. sound, black and white, 28 min.
The Case of the Barking Log or the Streambarker, 16mm. sound, color, 10 min.

(Continued on page 16A)

No school's too small  ...or too large  ...for Shopsmith

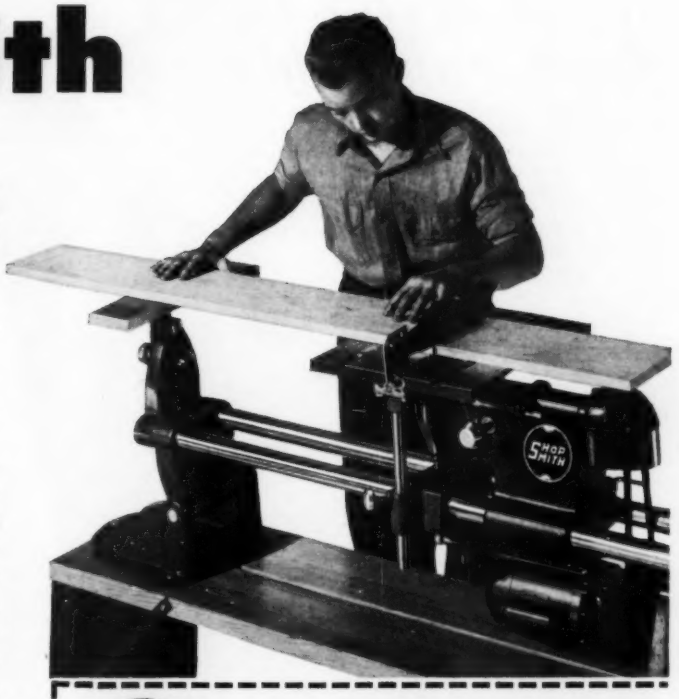
It's easy enough to see where multi-purpose SHOPSMITH fits into the shop program of smaller schools. One SHOPSMITH takes the place of five individual tools – circular saw, disc sander, wood lathe, vertical and horizontal drill press. It saves space. And it means a better equipped shop on a lower budget.

But what place has SHOPSMITH in large, well-equipped school shops?

You find the answer in SHOPSMITH's *flexibility*. A shop that has several SHOPSMITHS is a *Flexible Shop*. It can be changed to meet the needs of any group of students, any projects, any teaching techniques. In the *Flexible Shop*, machines and students need never stand idle, since the SHOPSMITHS can be converted to relieve congestion or tie-ups. The shop operates at 100% efficiency. Students learn faster. Instruction becomes more effective.

Basic SHOPSMITH costs $189.50 without motor, $232.45 with ½-hp. motor and special school guards. It has been tested and approved by prominent industrial arts educators. Write for specifications of SHOPSMITH and information about the *Flexible Shop*.

Magna Engineering Corporation



SHOP SMITH

MAGNA ENGINEERING CORPORATION

Dept. 201-U, *at factory nearest you*
12819 Coit Road, Cleveland 8, Ohio, OR
Menlo Park, California

Please send me complete information about the *Flexible Shop* and the application of SHOPSMITH to industrial arts education.

*Name*_____ *Position*_____

*School*_____

*Address*_____

*City*_____ *State*_____

TEACHING MATERIALS

(Continued from page 206)

The Story of the Hi-Density Feeder, 16mm. sound, color, 12 min.
A Hidden World, 16mm. sound, color, 26 min.
Precision Investment Casting (Lost Wax Method), 16mm. sound, color, 12 min.

American Can Company
Home Economics Section
100 Park Avenue
New York 17, N. Y.
Alaska's Silver Millions, 16mm. sound and silent versions, 30 min.
Vitamin Rivers, 16mm. sound, color, 22 min.
Jerry Pulls the Strings, 16mm. sound, 30 min.

American Petroleum Institute
50 West 50th Street
New York 20, N. Y.
Victory's Oil, 16mm. sound, color, 30 min.

American Viscose Corporation
350 Fifth Avenue
New York 1, N. Y.
How Rayon is Made, 16mm. black and white, sound, 15 min.
How Rayon is Made, 35mm. black and white, sound, 67 frames
Science Spins a Yarn, 16mm. technicolor, sound, 25 min.

Arabian American Oil Company
505 Park Avenue
New York, N. Y.
Free on loan from
Modern Talking Picture Service
45 Rockefeller Plaza
New York 20, N. Y.
Desert Venture, 16mm. sound, color, 28 min.

Free on loan from
Princeton Film Center, Inc.
Princeton, N. J.
A New Frontier, 16mm. sound, color, 20 min.

Botany Mills, Inc.
16 West 46th Street
New York 19, N. Y.
Raising of the Sheep on the Western Ranches and the Processing of the Raw Wool into the Finished Product, 16mm. sound, color

Bray Studios, Inc.
729 Seventh Avenue
New York 19, N. Y.
Bray Library of Educational Films
Refining of Petroleum, 16mm. silent, black and white, 8 min., Rental 25¢ day plus transportation

Chicago Tribune
Tribune Tower
Chicago, Ill.
Trees to Tribune, 16mm. sound, black and white, 30 min.
Trees to Tribune, 16mm. sound, technicolor, 43 min.
All American Way, 16mm. sound, black and white, 28 min.
A Book Goes to Market, 16mm. sound, Kodachrome, 22 min.
1950 All Star — Eagle Football Game, 16mm. sound, black and white, 32 min.

Columbia Gas System, Inc.
120 East 41st Street
New York 17, N. Y.
The Toughest Inch, 16mm. sound, color, 20 min.
The Eternal Flame, 16mm. sound, color, 29 min.

Compressed Air and Gas Institute
1410 Terminal Tower
Cleveland 13, Ohio
Compressed Air in Action, slidefilm

(Continued on page 18A)

SHELDON
CHICAGO

A better Lathe from any angle

Judge it from any angle: for accuracy, stamina, rigidity or capacity (for size). Check its component parts—its spindle, spindle bearings, lead screw, apron, carriage, bed, gearing, or the power delivered by its drive—you will find the SHELDON Lathe a quality tool both in appearance and "under the hood".

Write for Catalog

SHELDON MACHINE CO., Inc., 4247 North Knox Ave., Chicago 41, Ill.

News Notes

♦ The Eastman Kodak Company has announced that there will be a scarcity of Kodak color film in Europe this summer due to European import restrictions.

This is particularly true of Kodachrome 35mm. and 828mm. and Kodachrome movie film. No one should expect to be able to procure Kodacolor Roll Film anywhere overseas. What color film may be available in England, France, and Switzerland is often hard to find and stocks are usually quickly depleted.

Black-and-white film was said to be in greater supply on the continent, but visitors are advised to bring along a few extra rolls of their favorite black-and-white film in case of emergency.

♦ The Ford Motor Company Fund Scholarship Board has met in Dearborn, April 7–8, to award 70 four-year college or university scholarships to the sons and daughters of Ford Motor Company employees who ranked highest in a nationwide competition this year.

Those selected will receive full tuition and a portion of their living costs at any American college or university they may choose to attend. In addition, the Fund will contribute an annual $500 cost-of-education grant to privately endowed colleges or universities for each scholarship winner in attendance.

♦ A new series of industrial education full-color film strips, "The Use of Machines in Our Industrial Life," prepared by Audio-Visual Division of Popular Science Publishing Company, 353 Fourth Avenue, N. Y., and Walker-Turner Division, Kearney & Trecker Corp. is now available to teachers and training specialists. These brand-new filmstrips are designed for junior and senior high school industrial-arts programs, vocational-industrial schools, and apprentice training programs. Made up of six full-length, 50-frame film strips in superb natural color, the series covers "Circular Saw," "Jig Saw," "Band Saw," "Drill Press," and "Shaper." All frames specially staged and filmed at Walker-Turner plant.

For further information on "The Use of Machines in Our Industrial Life" contact your local audio-visual dealer or the Audio-Visual Division of *Popular Science* directly.

♦ The United States Gypsum Company is celebrating the completion of its fiftieth year. In honor of the occasion they have published a 54-page book in colors telling all about the company, but also recording the interesting and important facts about gypsum. The book is well written and illustrated.

ATF

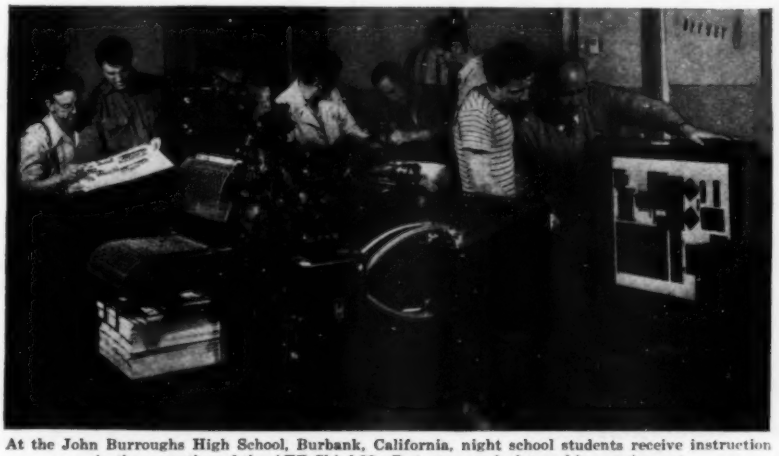
Good School News

GRAPHIC ARTS—THE EDUCATIONAL FIELD WITH A FUTURE

American Type Founders, Department of Education, 200 Elmora Avenue, Elizabeth, New Jersey

California Schools Install Offset Printing to Broaden Instruction in Graphic Arts

Educators take action to meet increasing demand for trained workers



At the John Burroughs High School, Burbank, California, night school students receive instruction in the operation of the ATF Chief 22 offset press and platemaking equipment.

More and more California schools are giving instruction in offset printing as part of their graphic arts courses in order to meet the steadily growing demand for trained offset pressmen, platemakers and cameramen.

During the past decade, the rapid growth of offset printing has resulted in a shortage of skilled workers. There is need for printers with good basic training in the fundamentals of the process as it can be taught in the offset printing schools.

Santa Barbara College of the University of California, leading industrial arts teachers training college on the Pacific Coast, anticipated this trend ten years ago when it added offset to its curriculum. An ATF Chief 22 offset press is used in this department.

Other California schools are now following suit, including offset printing in their graphic arts courses.

During the past two years the John Burroughs High School, Burbank, installed an ATF Chief 22 offset press and platemaking equipment.

The Los Angeles Trade Technical Junior College uses an ATF Chief 22 for training its students.

A complete offset plant was recently installed in the Harbor Junior College, Los Angeles. This installation includes an ATF Chief 22, a 14x17 ATF Process Camera, and platemaking equipment.

Chaffee College, Ontario, California, put in offset to facilitate training in the journalism department. It uses an ATF Chief 22 for printing its regular college newspaper.

Further information on the successful inclusion of offset printing in other schools is available from ATF's Department of Education.

Specialized Services for Schools

ATF maintains specialized services for vocational and industrial arts schools, as well as serving as a source of supply for equipment.

We shall be glad to put our Department of Education's engineering service to work with you in making an expert, efficient department or shop layout. We can also offer assistance in outlining training courses or in helping you find competent instructors.

Call on ATF today. Write for your copy of our booklet, "Graphic Arts, the Foundation of a Liberal Education."

High School Tabloid Newspaper Printed on ATF Little Giant 6

The Wildcat, tabloid school newspaper published by the Monrovia-Arcadia-Duarte High School, Monrovia, California, is printed on an ATF Little Giant 6 automatic cylinder press.

When open, the sheet size is 18"x24". However, the sheet was folded and run through the 12x18 press four times.

The ATF Little Giant 6 is an ideal press for student instruction. It is easy and safe to operate. It can also be used to print booklets, posters, bulletins, cards, almost every type of work that might be done in the school shop.

How the Graphic Arts Function in the Springfield Plan

Four junior high schools in Springfield, Mass., have graphic arts shops.

The primary aim of these courses is to tie in the academic work with some degree of manual craftsmanship and to bring home to the students the importance of printing in the everyday life of the community. They have played an important part in developing and publicizing the Springfield Plan for better community relations.

A 64-page book, the result of the cooperative efforts of Social Studies, English, Art and Printing classes in the elementary and junior high schools, might be called the "key" to the Springfield Plan. By printing, illustrating, and binding the writings of the students into volumes, the students could take the work of their classmates into their homes to be read by their parents.

It is a graphic example of how the Springfield Plan works to develop racial and religious understanding and tolerance, as well as to develop the craftsmanship of students.

TEACHING MATERIALS

(Continued from page 16A)

classroom lecture, 35mm. film, 2" x 2" slides

Denver and Rio Grande Western Railroad
605 Rio Grande Building
1531 Stout Street
Denver 1, Colo.
Black Power (Coal), 16mm. sound, color, 30 min.
Wine, 16mm. sound, color, 20 min.

Edited Pictures System
330 West 42nd Street
New York, N. Y.
Petroleum and Its Products, 16mm. sound, black and white, 9 min., Rental $1.50

Encyclopaedia Britannica Films, Inc.
712 North Haskell
Dallas, Tex.
Encyclopaedia Britannica Films Bring the World to You
Announcing 37 Important Teaching Films in 6 Important Subject Areas

Esso Standard Oil Company
15 West 51st Street
New York 20, N. Y.
Will be projected or may be borrowed in the following states only, Arkansas, Delaware, Louisiana, Maryland, New England States, New York, New Jersey, North Carolina, Pennsylvania, South Carolina, Tennessee, Virginia, West Virginia
Oil of Peru, 16mm. sound, color, 37 min.
Bouncing Molecules, 16mm. sound, color, 20 min.
Friction Fighters, 16mm. sound, color, 40 min.
Design for Power, 16mm. sound, black and white, 35 min.

Ethyl Corporation
100 Park Avenue
New York 17, N. Y.
Flames of Progress, 16mm. sound, black and white, 11 min.
Gasoline for Everybody, 16mm. sound, black and white, 13 min.

General Electric Company
Distribution Section
Advertising and Sales Promotion Division
Schenectady 5, N. Y.
(Requests should be sent to nearest General Electric Company office — obtain address from above office.)
By Their Works, 16mm. sound, black and white, 44 min., No. AS–2665
A Chance to Play, 16mm. sound, black and white, 20 min., No. S–2674
Clean Waters, 16mm. sound, color, 20 min., No. AS–2588
The World's Largest Electrical Workshop, 16mm. sound, black and white, 30 min., No. S–2428
Life Streams of the City, 16mm. sound, color, 15 min., No. AS–2584
Power By Which We Live, 16mm. sound, color, 20 min., No. S–2614

General Motors Corporation
Department of Public Relations — Film Section
General Motors Building
Detroit 2, Mich.
Requests from Arizona, California, Colorado, Idaho, Montana, Nevada,

(Continued on page 22A)

ELIMINATE

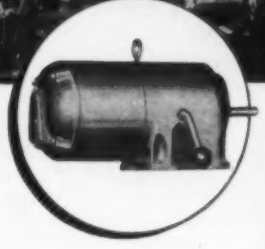
HAZARDOUS

LINESHAFTING

Specifically designed to individually motorize machine tools originally driven by lineshaft, LIMA GEARSHIFT DRIVES were selected by Ohio State University to provide its students with the very best in modern machine shop equipment.

Ohio State is but one of many schools throughout the nation that have modernized their machine shops with LIMA DRIVES, providing the utmost in functional safety, adequate lighting, proper machine location and the complete elimination of hazardous lineshafting.

Ohio State's completely modernized Industrial Engineering Department



• *Selective Speed* LIMA GEARSHIFT DRIVES for application to all types of machine tools and production equipment are built in sizes from ½ to 25 HP.

Complete engineering facilities available.

LIMA

WRITE FOR LITERATURE

Representation in principal cities

GEARSHIFT DRIVES & MOTORS

THE LIMA ELECTRIC MOTOR COMPANY 3451 FINDLAY ROAD, LIMA, OHIO

New Publications

Automobile Body Repair and Paint Guide

By William T. Athanson. Cloth, 95 pp., 4¾ by 7½ in., illus., $1.60. D. Van Nostrand Co., Inc., New York, N. Y.

This practical guide gives easily understood instructions on automobile body repair and painting. The book is divided into two parts, "Automobile Sheet Metal Repair Guide" and "Automobile Paint Guide." Each part begins with a glossary of terms used in that trade and includes descriptions and illustrations of the commonly used tools.

Book I contains information on shrinking metal, soldering, sweating, brazing, welding, panel installation, body leaks, and seals, etc.

Book II explains the rules of good painting, the difference between enamels and lacquers, the preparation of metal for painting, the procedures necessary to avoid common painting problems, etc.

The Welding of Non-Ferrous Metals

By E. G. West. Cloth, 553 pp., 5⅝ by 8¾ in., illus., $8.50. John Wiley & Sons, Inc., New York, N. Y.

This text is a comprehensive exposé of the weldability of metals other than iron and steel. The author clearly explains the welding process or processes to use when welding such metals as aluminum and its alloys, copper and its alloys, lead, magnesium alloys, molybdenum, nickel, nickel-chromium-iron, zinc sheet, zinc-base die castings, gold, silver, platinum, tantalum, and titanium.

The book contains much technical information that is especially important to the welder, and contains many diagrams and tables.

Sheet Metal Work

By Robert E. Smith. Paper, 76 pp., 7¾ by 10¼ in., illus. McKnight & McKnight Publishing Co., Bloomington, Ill.

A useful text for the beginner in sheet-metal work.

The subject matter is divided into 22 units which explain the safety precautions to be observed, the making of layouts, the cutting of sheet metal, the use of stakes, bending of metal, the use of the ordinary stakes and machines found in the sheet-metal shop, maintenance and

(Continued on page 24A)

FREE NEW K&E SCHOOL CATALOG...

"Drafting Instruments & Materials"

Just return the coupon below for your free copy of the K&E 1952 School Catalog—a helpful 40-page handbook of the leading line of drawing instruments and materials for use in your classroom.

Whether you are actually in the market now for these products or not, it will pay you to send for this catalog as a useful reference book for later on.

K&E

Drafting, Reproduction and Surveying Equipment and Materials, Slide Rules, Measuring Tapes.

KEUFFEL & ESSER CO.
ADAMS & THIRD STREETS, HOBOKEN, N. J.

Gentlemen: Please send me without obligation your 1952 Catalog "Drafting Instruments and Materials."

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SCHOOL_____

DEPARTMENT_____

STREET_____

CITY_____ ZONE_____ STATE_____

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EST. 1867

NEW YORK • HOBOKEN, N. J.
CHICAGO • ST. LOUIS • DETROIT • SAN FRANCISCO
LOS ANGELES • MONTREAL

WESTON *Instruments*

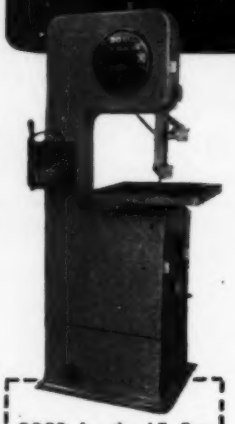
From simple galvanometers or multi-purpose test units, to precise laboratory standards . . . WESTON Instruments inspire their users to new achievements in their quest for knowledge.

Students soon learn to admire the accuracy for which WESTONS have long been famous. Instructors appreciate their stamina and dependability. Critical research workers place full confidence in their indications. And practical administrators know that their year-after-year dependability makes the cost of WESTON equipment remarkably low.

Literature illustrating and describing many types of WESTON instruments widely used in the educational field gladly sent on request. Write today.

WESTON ELECTRICAL INSTRUMENT CORPORATION
617 Frelinghuysen Avenue, Newark 5, N. J.
Manufacturers of Weston and TAGliabue Instruments

PRICED AND DESIGNED WITH THE SCHOOL SHOP IN MIND



DoALL UTILITY BAND MACHINE
DOUBLE RANGE • VARIABLE SPEED
16" COMBINATION WITH WELDER
SAWS • FILES • POLISHES

GOOD for the I.T. Program
BETTER for the School Shop Budget
BEST for the Student

STUDENTS quickly acquire skill, develop pride of accomplishment and enjoy learning to machine a great variety of materials with professional ability on this safe, easy to operate contour sawing, filing, polishing machine.

Because of its construction features and responsive control of variable tool speed in both high and low range, the Utility DoALL is capable of turning out school shop projects to the most exacting standards of workmanship and accuracy.

This machine invites comparison—price and performance. Ask for a free demonstration. Call your local DoALL Sales-Service Store or write:

SEND FOR BULLETIN

DoALL

THE DoALL COMPANY
254 N. Laurel Ave.
Des Plaines, Illinois

8-14

HARPER ELECTRIC KILNS

1½ cu. ft. Kiln installed at State Teachers College, Buffalo, N. Y.

Contribute **to the best CERAMIC TRAINING**

Harper

BECAUSE they provide a wide temperature range within which all types of high and low temperature Ceramic ware can be *properly* fired.

BECAUSE they are clean, noiseless and safe to operate as an electric stove.

BECAUSE they are expertly designed and sturdily constructed to operate dependably for many years with a minimum of maintenance.

Leading SCHOOLS and UNIVERSITIES are using HARPER ELECTRIC KILNS to provide their students with the finest Ceramic training and also because they have found Harper Kilns to be more economical to operate in the long run.

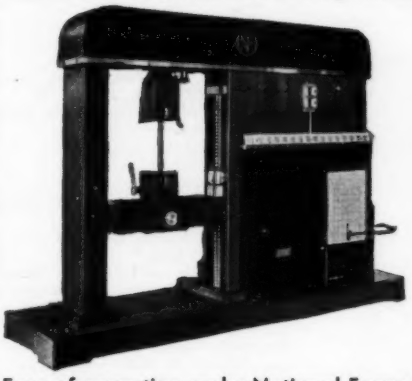
Write for information on Harper Kilns to meet your Ceramic Department requirements. They are available in sizes from ½ to 18 cubic feet for operation to 3 top temperatures, 2100° F., 2500° F. and 2750° F.

HARPER ELECTRIC FURNACE CORPORATION
Dept. 3 • 39 River Street • Buffalo 2, New York

Ideal for Classroom Instruction

NATIONAL FORGE

Universal Testing Machine



Model TMU — Only 44 in. High, 15,000-lb. or 30,000-lb. Capacity

Ease of operation make National Forge Universal Testing Machines ideal for school instruction tests of a great variety of materials and specimen sizes. Compact, rugged, dependable. A.S.T.M. accuracy. Three scale ranges on each machine give widespread utility. Controls are simplified, with safety cutouts. Infinitely-variable speed. Moderate in price.

WRITE FOR BROCHURE 501

Testing Machine Division

NATIONAL FORGE AND ORDNANCE COMPANY

Dept. IA, Irvine, Warren County, Pennsylvania

DELIVERY NOW!
SJÖSTRÖM WORK BENCHES
We can offer immediate delivery on sturdily constructed, single and double type Sjöström Work Benches. For construction details, specifications and dimensions, write for our Work Bench Data Sheet which describes all available types.

JOHN E. SJÖSTRÖM COMPANY

1712 N. Tenth Street, Philadelphia 22, Penna.

PORTER CABLE New Speedmatic

DUSTLESS BELT SANDER

HERE'S PROOF Make this simple comparison test. Take two fir boards measuring 2" x 12" x 18". Weigh them. Using new #50 Garnet belts, place the new 3-inch Dustless 503 on one board, any ordinary belt sander of like size on the other. Run both sanders a half-hour. Reweigh the boards. You'll find the Dustless 503 *removes twice as much stock!*

MAINTENANCE WORK SPEEDED The 503's powerful vacuum system picks up 85% of all dust—keeps both work-piece and work-room cleaner. Belt doesn't load up quickly—far more grits are left exposed to do the cutting. Shop and maintenance jobs are finished in half the time!

FEWER SPOILED PROJECTS The 503 operates at a lower belt speed. Slower speed and cleaner belt mean no excessive heat to burn the work . . . just cool, even sanding that helps students do finer finishing.

ADVANCED FEATURES Shorter, heavier jackshaft preserves worm gear alignment . . . oil level window tells when gears need oiling . . . leak-proof filler cap makes lubricating a cinch.

See the new 3-inch Dustless 503 at your Speedmatic Dealer's. Or mail coupon today.

PORTER-CABLE Machine Co.
4126 N. Salina St., Syracuse 8, N. Y.

MAIL TODAY!

Please send full information on the new Speedmatic 503 Dustless Sander . . . also name of nearest dealer.

Name.....

Position.....

School.....

Address.....

City..... **State**.....

Manufacturers of SPEEDMATIC and GUILD Electric Tools
In Canada write: Strongridge, Ltd., London, Ont.

TEACHING MATERIALS

(Continued from page 18A)

New Mexico, Oregon, Utah, Washington, and Wyoming address to:
General Motors Corporation
508 San Francisco Building
405 Montgomery Street
San Francisco 4, Calif.

Requests from Greater New York City and the Communities of Long Island address to:
General Motors Corporation
Department of Public Relations
1775 Broadway
New York 19, N. Y.

The Questing Mind, 16mm. sound, color, 20 min.
Quality in the Making, 16mm. sound, 23 min.
The Easier Way, 16mm. sound, 13 min.
An American Miracle, 16mm. sound, 18 min.
King Cotton, 16mm. sound, 17 min.
Sand and Flame, 16mm. sound, 20 min.
Precisely So, 16mm. sound, 18 min.
Our American Crossroads, 16mm. sound, color, 26 min.
General Motors Institute, 16mm. sound, 27 min.
Doctor in Industry, 16mm. sound, 60 min.
Experiment, 16mm. sound, 12 min.
The Price of Freedom, 16mm. sound, 23 min.
Oil Films in Action, 16mm. sound, color, 18 min.

Hammermill Paper Company
Erie, Pa.
The Gift of Ta'al Lun — Paper, 16mm. sound, 1200 foot reel, 33 min.

Hercules Powder Company
Wilmington, Del.
Problem-Solution-Result, 16mm. sound, color, 25 min.
Careers for Cellulose, 16mm. sound, color, 30 min.
Reclaiming Land With Dynamite, 16mm. sound, color, 10 min.
Figures of Quality, 16mm. sound, color, 10 min.

Humble Oil and Refining Company
P.O. Box 2180
Houston 1, Tex.
Humble's Four Star War Products, 16mm. sound, color, 40 min.
Hazardous Helper, 16mm. sound, color, 16 min.
More Than Magic, 16mm. sound, color, 18 min.
Oil, 16mm. sound, color, 23 min.
Portable Well Servicing Unit, 16mm. sound, color, 28 min.
Trouble Lurks Below, 16mm. sound, color, 30 min.
Thermal Forces, 16mm. sound, color, 20 min.
Highway for Oil, 16mm. sound, color, 30 min.
Pipeline for Progress, 16mm. sound, color, 26 min.
Captain Caution, 16mm. sound, black and white, 20 min.

Iowa State College
Visual Instruction Service
Ames, Iowa
Catalog of Audio-Visual Aids

Kendall Refining Company
Bradford, Pa.
Nature Plays Favorites, 16mm. sound, color, 25 min.

Library Films, Inc.
25 West 45th Street
New York 19, N. Y.
Catalog of 16mm. Sound on Film

Lion Oil Company
Public Relations Department
El Dorado, Ark.
Revolution in the South, 16mm. sound, color, 24 min.

Magnolia Petroleum Corporation
Magnolia Building
P.O. Box 900
Dallas, Tex.
The Undersea Search for Oil, 16mm. sound, color, 20 min.

Magnolia Pipe Line Company
Box 900
Dallas 1, Tex.
Underground River, 16mm. sound, color, 30 min.

Metropolitan Life Insurance Company
School Health Bureau
Health and Welfare Division
1 Madison Avenue
New York 10, N. Y.
Catalog of Films on Health and Safety

Minneapolis-Honeywell Regulator Company
Minneapolis 8, Minn.
Basic Study of Home Heating, 35mm. filmstrip, No. 201, $2
Oil Burner Service and Installation, 35mm. filmstrip, No. 203, $2
Fundamentals of Gas Controls, 35mm. filmstrip, No. 206, $2

Modern Talking Picture Service, Inc.
Chicago, Ill.
Men and Oil, 16mm. sound, black and white, 21 min.

National Board of Fire Underwriters
85 John Street
New York 38, N. Y.
Tony Learns About Fire, 16mm. sound

National Child Labor Committee
419 Fourth Avenue
New York 16, N. Y.
Slide Lecture — lecture on the kinds of work children do, illustrated with 56 lantern slides. Loaned for $2 and return postage.

National Highway Users Conference, Inc.
952 National Press Building
Washington 4, D. C.
Horizons Unlimited, 16mm. or 35mm. sound, black and white, 17 min.

Ohio Oil Company
539 South Main Street
Findlay, Ohio
Unseen Horizons, 16mm. sound, color, 30 min.

Oil Industry Information Committee, The
American Petroleum Institute
50 West 50th Street
New York 20, N. Y.
The Last Ten Feet, 16mm. sound, black and white, 20 min.
24 Hours of Progress, 16mm. sound, black and white, 28 min.

Pacific Coast Gas Association
447 Sutter Street
San Francsico, Calif.
The Miracle Flame, 16mm. sound, color, 20 min.

Proctor and Gamble Company
Cincinnati 1, Ohio
Scrub Game, distributed by Modern Talking Pictures, 45 Rockefeller Plaza, New York City, 30 min.

Richfield Oil Corporation
555 South Flower Street
Los Angeles 13, Calif.
The Years Ahead, 16mm. sound, color, 30 min.

Shell Oil Company, Inc.
50 West 50th Street
New York 20, N. Y.

100 Bush Street
San Francisco 6, Calif.
Oil From the Earth, 16mm. sound, black and white, 18 min.
Prospecting for Petroleum, 16mm. sound, 35mm. sound, color, 23 min.
10,000 Feet Deep, 16mm. sound, black and white, 20 min.
Birth of An Oil Field, 16mm. sound, color, 31 min.

(Continued on page 27A)

PARKS No. 20
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Here is a modernly designed, rugged, high-speed, low-priced planer that is ideally suited for every shop and industrial plant requiring a quality surfacer. The Parks No. 20 Planer has a four-knife cutterhead with a speed of 3600 R.P.M. and offers two feed speeds — 20 and 40 F.P.M., and 40 and 80 F.P.M. Write for complete descriptive literature.

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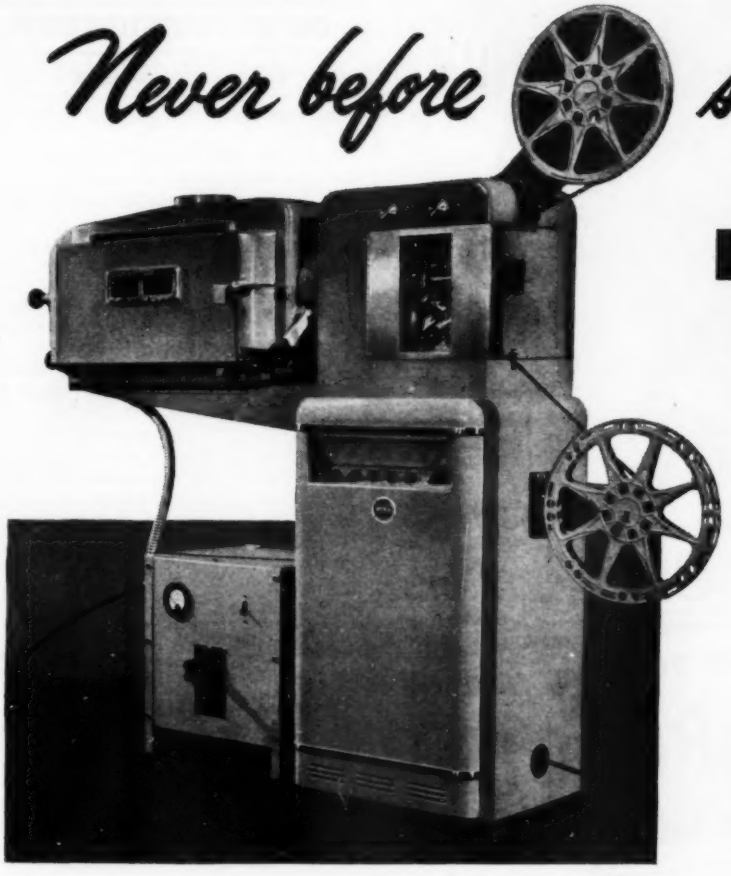

IN 16mm. MOVIES

The Eastman 16mm. Projector, MODEL 25

The complete high-intensity Model 25 arc unit, ready for use. While designed and constructed to be your permanent 16mm. installation, it is nevertheless portable with minor disassembly. (The tungsten model, shown below, will be found adequate for average-sized halls and auditoriums.)

Designed for theater-quality performance even under difficult conditions, this new precision-made, heavy-duty sound projector gives you the ultimate in 16mm. sound and image.

Its design principles are unique. A geneva movement operating in a sealed oil bath is the intermittent mechanism. It transports films surely and gently. Separate motors drive the geneva movement, the main projector mechanism, blower, and reel arms—eliminating belt and chain drives—isolating the projector from the shock sources these create.

The screen image is flawlessly brilliant. Kodak's finest optical system—*Lumenized* Kodak Projection Ektar Lenses *f*/1.5 (in a choice of four focal lengths)—provides a picture in sharp over-all focus, with a complete, natural range of color tones.

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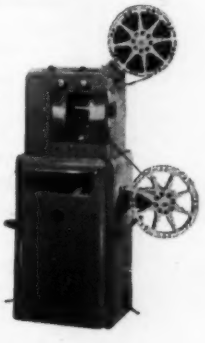
In short, the Model 25 will stand up and deliver the very best in sound and image, year after year. For complete details, see your Kodak Audio-Visual Dealer—or mail us the coupon below.



MOTION PICTURES

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193

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

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2-Speed Element Reaches Soldering Heat In 40 Seconds

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Write for literature on Vari-Hot iron, special Industrial Catalog and general catalog of 4,000 Snap-on tools for production and maintenance.

*Snap-on is the trademark of Snap-on Tools Corporation

SNAP-ON TOOLS CORPORATION
8074-F 28th Avenue, Kenosha, Wis.

NEW PUBLICATIONS

(Continued from page 18A)

adjustment practices, sheet-metal joints, and soldering.

The book also contains a number of useful tables, a bibliography of reference books, and eight layouts of suggestive projects which the students can make or adapt.

General Shop for Everyone

By Louis V. Newkirk. Cloth, 261 pp., 6¾ by 9¼ in., illus., $3.20. D. C. Heath & Co., Boston, Mass.

An excellent book on the general shop written by a man who can boast of 25 years of teaching and supervising general shop classes.

It is a basic text for a general shop in which drawing and planning, woodworking, metalworking, electricity, and plastics are taught.

Each unit presents information about the workers and their jobs in that particular field, calls attention to safety precautions that are to be observed in school and on the job, describes the tools that are used, and suggests problems and projects that the student can undertake.

Automotive Maintenance and Trouble Shooting

By Irving Frazee and Earl L. Bedell. Cloth, 414 pp., 5¾ by 8½ in., illus. American Technical Society, Chicago, Ill.

This book, written by experts, is planned to be of real help to the industrial auto mechanic.

Its topical arrangement is such that the mechanic can quickly refer to the specific subdivision of the trouble which he is to remedy.

This is accomplished by having the left page running heads give the chapter heads while the heads on the right-hand pages give the suggested remedial operations.

The book is up to date giving modern maintenance practice and suggesting the tests that are to be made in locating the reasons for the trouble.

General Woodworking

By Chris H. Groneman. Cloth, 220 pp., 6¾ by 9½ in., illus., $3. McGraw-Hill Book Co., Inc., New York, N. Y.

A text for students of general woodworking. The book is divided into five sections. The first of these is devoted to general information. The next to the hand-tool processes. The third to machine-tool processes. The fourth to related information, and section five to suggested projects.

The illustrations are good throughout the book and they and the clear explanatory matter make this a fine book for the first- or second-year student of woodworking.

Basic Mathematics for Technical Courses

By Clarence E. Tuites. Cloth, 438 pp., 6¼ by 9$^{5}/_{16}$ in., illus., $3.75. Prentice-Hall, Inc., Publishers, New York 11, N. Y.

This is the second edition of this textbook which contains new as well as rewritten material.

The approach used by the author is general enough to apply to other technical fields.

The slide rule is taken up in the first chapter of the book so that the student becomes conversant with that mathematical instrument which is used to such a great extent in the various branches of engineering.

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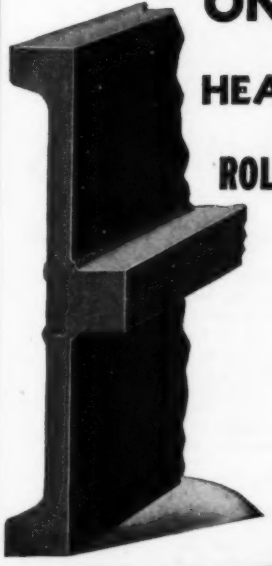

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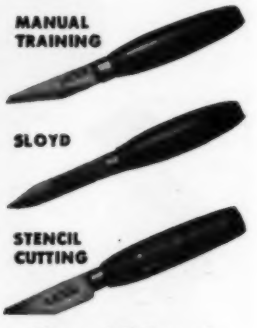

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TEACHING MATERIALS

(Continued from page 22A)

Crude Oil Distillation, 16mm. sound, black and white, 13 min.
Refining Oil for Energy, 16mm. sound, color, 22 min.
Harnessing Liquids, 16mm. sound, black and white, 12 min.
Oil for Aladdin's Lamp, 16mm. sound, black and white, 24 min.
Pipeline, 16mm. sound, color, 22 min.

Socony-Vacuum Oil Company, Inc.
26 Broadway
New York 4, N. Y.
America's Choice, 16mm. sound, color, 31 min.
Behind the Checkered Flag, 16mm. sound, color, 25 min.
Driftwood Derby, 16mm. sound, color, 16 min.
From the Ground Up, 16mm. sound, black and white, 45 min.
And Then There Were Four, 16mm. and 35mm. black and white, 27 min.

Southern California Gas Company
810 South Flower Street
Los Angeles 14, Calif.
A Pipe Line Licks the Weather, 16mm. sound, color, 20 min.
Westward Flow, 16mm. sound, color, 29 min.

Standard Oil Company
Room 1626
30 Rockefeller Plaza
New York 20, N. Y.
The Oil Hunters, film strip
Drilling for Oil, film strip
Petroleum Refining, film strip

Standard Oil Company
Chicago, Ill.
Oil and Men, 16mm. sound, black and white, 28 min.
Stan, 16mm. sound, black and white, 72 min.
Gasoline's Amazing Molecules, 16mm. sound, color, 22½ min.

Standard Oil Company of California
225 Bush Street
San Francisco 20, Calif.
Not Loaned. Bookings made by local Standard Oil Company of California representatives and films shown on request by company representatives in Arizona, California, Idaho, Oregon, Nevada, Utah, and Washington.
Lifestream — The Role of Oil in the Modern World, 16mm. sound, color, 31 min.
Seeing is Believing, 16mm. sound, black and white, 28 min.

Sun Oil Company
Motor Products Department
1608 Walnut Street
Philadelphia 3, Pa.
Merchant of Main Street, 16mm. sound, color, 15 min.

Swank Motion Pictures, Inc.
614 North Skinker Blvd.
St. Louis 5, Mo.
A New Instructional Film Catalog Film and Equipment News

Texas Company, The
135 East 42nd Street
New York 17, N. Y.
Deep Horizons, 16mm. sound, color, 32 min.
Masters of Molecules, 16mm. sound, color, 21 min.
Research — Pattern for Progress, 16mm. sound, color, 30 min.
Desert Venture, 16mm. sound, color, 28 min.
A New Frontier, 16mm. sound, color, 25 min.

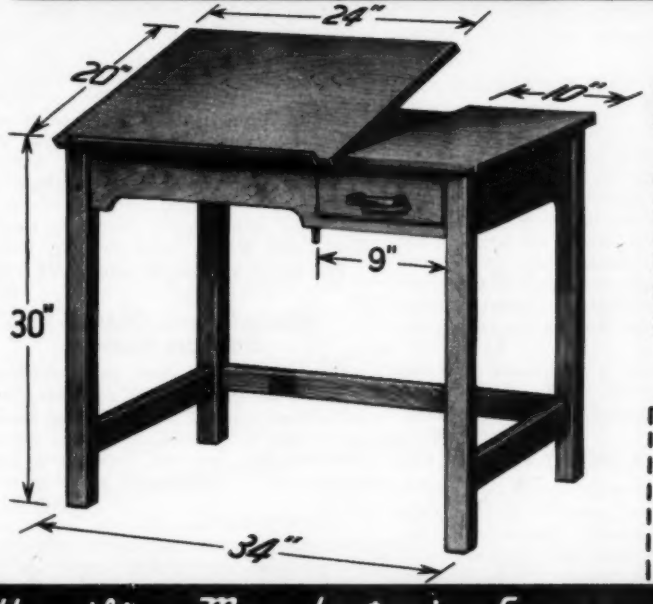
Union Oil Company of California
Union Oil Building
Los Angeles 14, Calif.
Free on Loan from:
Modern Talking Picture Service, Inc.
45 Rockefeller Plaza
New York 20, N. Y.

United States Bureau of Mines
Experiment Station
4800 Forbes Street
Pittsburgh 13, Pa.
Wyoming and Its Natural Resources, 16mm. sound, color, 30 min.
Valves — Their Manufacture and Use, No. 140, 2 reels, 16mm. silent
Reel 1: Close-up Views and Cross sections
Reel 2: Forging Steam Valves
Wildwood — Mechanized Coal Mining, No. 142, 2 reels, 16mm. silent
Made in co-operation with the Westinghouse Electric Corp.
Automobile Lubrication — No. 151, 1 reel, 16mm. silent
Made in co-operation with the Standard Oil Company
Safety Glass — No. 162, 2 reels, 16mm. silent
Reel 1: Quarrying and Preparing Silica Sand
Reel 2: Ground Sheets Being Polished
Made in co-operation with Ford Motor Company
Arizona and Its Natural Resources — No. 178, 16mm. sound, color
Made in co-operation with Phelps Dodge Corporation
Manufactured Abrasives — No. x185, 16mm. sound
Made in co-operation with the Carborundum Company
The Evolution of the Oil Industry — x187, 16mm. sound
Made in co-operation with the Sinclair Refining Company
Sulphur — No. x188, 16mm. sound
Made in co-operation with the Texas Gulf Sulphur Company
Heat and Its Control — No. x192, 16mm. sound
Made in co-operation with Johns-Manville Corporation
The Story of Rock-Wool Home Insulation — No. x193, 16mm. sound
Made in co-operation with the Johns-Manville Corporation
First Steps in First Aid — No. x199, 16mm. sound
Made in co-operation with the Upjohn Company
Help Wanted — No. x200, 16mm. sound
Made in co-operation with the Johnson and Johnson Company
Texas and Its Natural Resources — No. x216, 16mm. sound
Made in co-operation with Texas Gulf Sulphur Company
Oklahoma and Its Natural Resources — No. x223, 16mm. sound
Made in co-operation with the Sinclair Refining Company
California and Its Natural Resources — No. x226, 16mm. sound
Made in co-operation with Richfield Oil Corporation
Ohio and Its Mineral Resources — No. x227, 16mm. sound, color
Made in co-operation with Standard Oil Company
Man-Made Canyon, No. x232, 16mm. sound
Made in co-operation with International Nickel Company, Inc.
Missouri and Its Natural Resources — No. x237, 16mm. sound, color
Made in co-operation with Sinclair Refining Company
Treasure From the Sea — No. x238, 16mm. sound, color
Made in co-ooeration with Dow Chemical Company
Oregon and Its Natural Resources, No. x242, 16mm. sound, color
Made in co-operation with Richfield Oil Corp.
West Virginia and Its Natural Resources, No. x241, 16mm. sound
Produced in co-operation with Weirton Steel Company

(*To be continued*)

by Hamilton

STUDENT TABLE V-1704



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SHOP EQUIPMENT NEWS

WELLER SOLDERING GUN GETS IMPORTANT JOB

A Weller Soldering Gun figured prominently in an announcement of historic importance by the National Bureau of Standards.

The cut released by the Bureau shows one of the final steps in the preservation of the original Declaration of Independence. The Bureau's scientists, to protect the precious document, *sandwich* it between sheets of glass with special filters to absorb harmful violet and ultraviolet rays. Atmospheric oxygen and other gases which cause deterioration are evacuated from the case and inert hellium is introduced. A sensitive, leak-detecting tube was then soldered into place with a Weller soldering gun, the stainless steel frame was hermetically sealed, air was evacuated and helium was forced into the frame under pressure.

The 176-year-old document, so laboriously handwritten, is the equal of any modern printing process in the delicacy and grace of its lettering. It is hoped that the words of the document will be preserved for many future generations of Americans to read and consider.

For brief reference use IAVE—0601.

THE 1952 K AND E CATALOG

The 1952 K and E catalog of Drafting Instruments and Materials has recently been published by the Keuffel and Esser Company.

It makes a decidedly appealing booklet published as it is in colors. It describes the various grades of drawing sets marketed by this firm; beam and combination compasses; regular and long line, and wide line ruling pens; proportional dividers; drawing and tracing paper, cross section and graph sheets of many types; triangles, protractors, irregular curves, T squares, lettering sets, slide rules, and teaching aids.

Write for your copy to *Keuffel and Esser Co., 300 Adams St., Hoboken, N. J.*

For brief reference use IAVE—0602.

DELTA SCHOOL CONTEST PROGRESSES

The school-shop layout contest, started in November, 1951, and sponsored by the Delta Power Division, Rockwell Manufacturing Co., Pittsburgh, has produced over 4000 entries to date. Under the title theme, "School Shops for Today and Tomorrow," Delta's school shop layout was developed in an effort to gather and present the most advanced thinking in school shop layout.

The contest, which officially closes July 31, is open to schoolmen engaged in instruction, supervision, or administration of industrial arts, industrial and vocational education, and to graduate and undergraduate students at accredited teacher-training colleges. Prize and award winners will be announced concurrently with the American Vocational Association convention in Boston next November.

Contest entry kits may still be obtained by writing to *Delta Power Tool Division, Rockwell Manufacturing Company, 400 N. Lexington Ave., Pittsburgh 8, Pa.*

For brief reference use IAVE—0603.

CLAMPS — THEIR HISTORY AND USES

The Cincinnati Tool Company has recently published an excellent little booklet on "Clamps — Their History and Their Uses."

It is well illustrated and the historical notes, going back to 250 B.C., are interestingly told. More recent history is covered by a full description of the part played by the Cincinnati Tool Company since 1879 in the manufacture and improvement of the many types of clamps now used in industry.

Besides the full description of the clamps, there also is a chapter on "Suggestions on the Use of Clamps."

Get a copy of this interesting brochure by writing to the *Cincinnati Tool Co., 1966 Waverly Ave., Cincinnati 12, Ohio.*

For brief reference use IAVE—0604.

HOW TO RUN A METAL WORKING SHAPER

Another new how-to book has just been published by the South Bend Lathe Works. Its title is *How to Run a Metal Working Shaper.*

The manual thoroughly covers the setup and operations of the metalworking bench shaper, and contains over 65 photos, diagrams, and exploded views clearly showing the internal parts of a shaper, and how to grind differently formed tool bits for shaper cuts.

Vocational directors and shop instructors may receive free sample copies of *How to Run a Metal Working Shaper* on request. A nominal charge of 25 cents is made for single copies which may be obtained from any South Bend distributor or by writing directly to the *South Bend Lathe Works, South Bend 22, Ind.*

For brief reference use IAVE—0605.

EDUCATIONAL CHARTS AND DISSTON MANUAL

Henry Disston and Sons, Inc., publish a saw, tool, and file manual which is replete with historical and practical information on hand and power saws of all kinds, for wood- and metal-workers; also files and rasps, bevels, gauges, levels, scrapers, trowels, and a variety of other tools.

This firm has also prepared six educational charts for the school and home shop on how to use the hand saw, the different kinds of saw cuts, hack saws and how to use them, Disston files, turning chisels, and special purpose saws of various kinds.

(Continued on page 30A)

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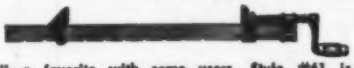

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SHOP EQUIPMENT NEWS

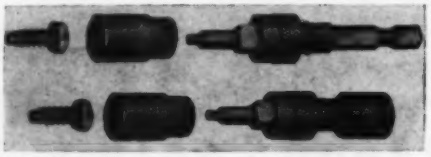
(Continued from page 28A)

Teachers of woodwork, metalwork, and machine-shop practice will find the manual and the educational charts very useful. If you are interested write to *Henry Disston and Sons, Inc., Tacony, Philadelphia 35, Pa.*

For brief reference use IAVE — 0606.

WILLIAMS MAGNETIC DRIVING DEVICES FOR USE WITH SMALL POWER SCREW DRIVERS AND WRENCHES

A new magnetic adapter and magnetic hexagon-square shank (patents pending) have been developed for use only with Williams Impact "Supersockets" to drive hex head hardened and self-tapping screws.



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A catalog sheet giving complete description is available on request from *J. H. Williams & Co., 400 Vulcan St., Buffalo 7, N. Y.*

For brief reference use IAVE — 0607.

STEEL WOOL USES

The Williams Co., London, Ohio, has published a chart on steel wool uses which will be found useful to the students in the school shop.

The chart gives the grade and texture of each kind, and also enumerates for what type of work each kind is best suited.

For further information write to *The Williams Company, manufacturers of Sun Ray Steel Wool, London, Ohio.*

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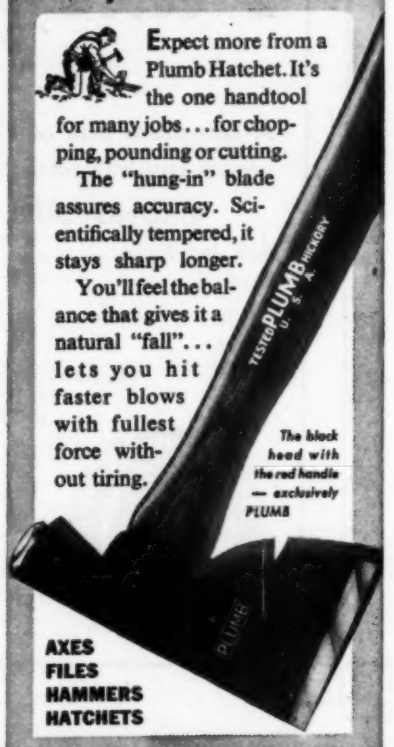

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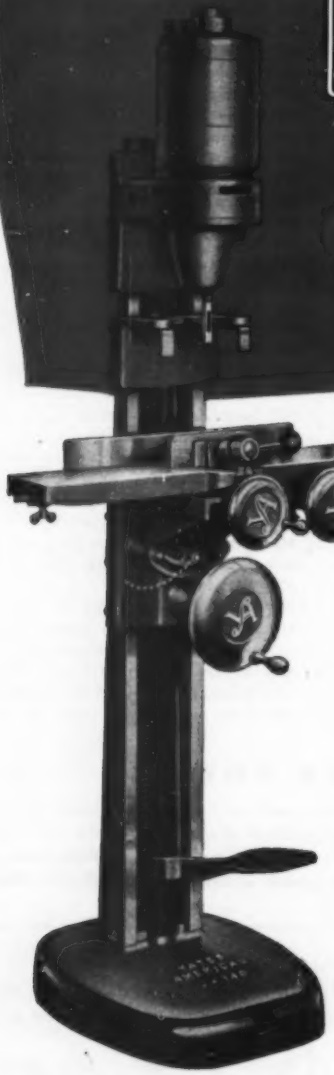

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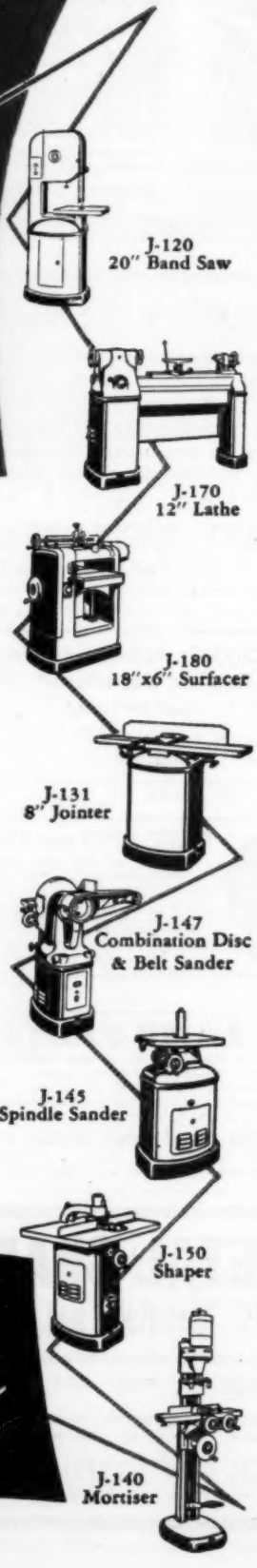

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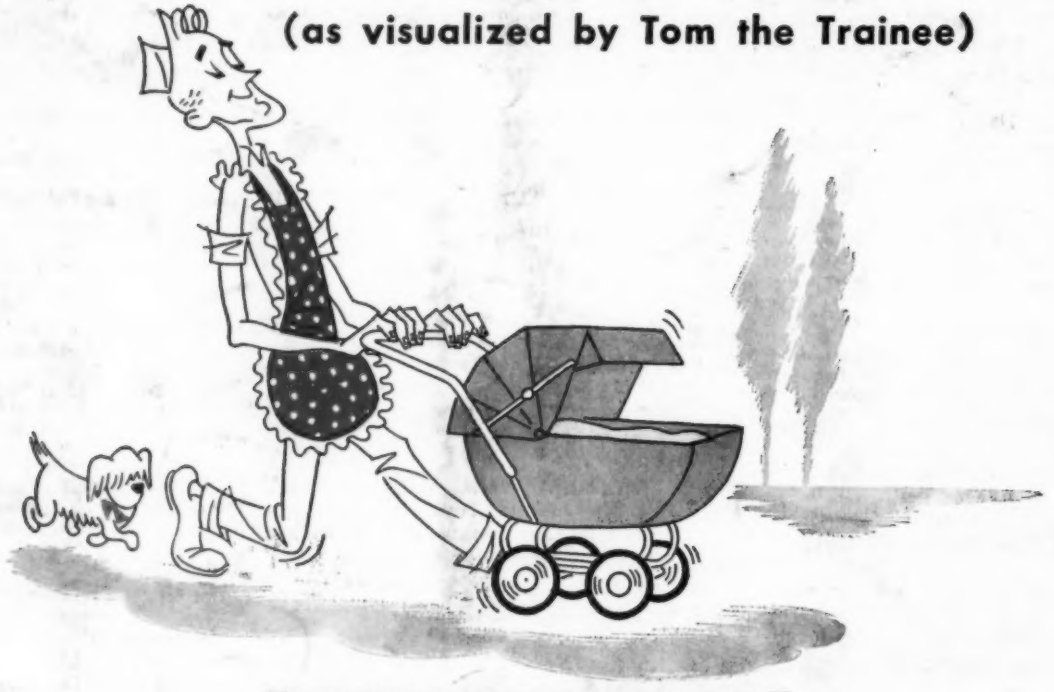

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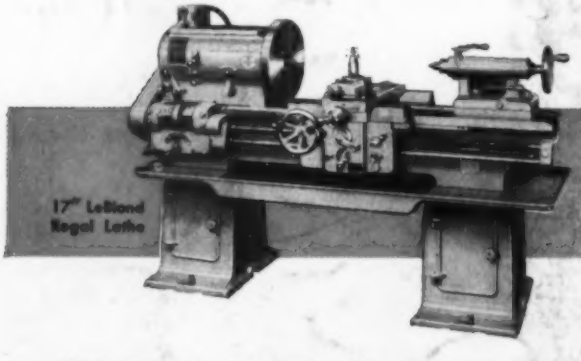

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